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ATLANTA TOWER CAB AND TRACON EQUIPMENT INTEGRATION ANALYSIS

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16. Abstract

This report presents an analysis of how the new Terminal Information Processing System (TIPS) and Consolidated Cab Display (CCD) equipments might appear to Air Traffic personnel if they were installed in the tower cab and TRACON at Hartsfield-Atlanta Airport. The analysis includes an operations analysis of the current Atlanta tower cab and TRACON operations, and preliminary designs of the TIPS and the CCD as applied to those operations. In addition, the potential integration of the two systems is discussed.

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PREFACE

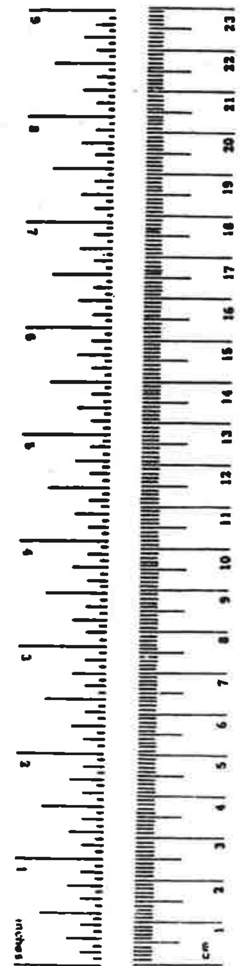
This report documents the analysis of the Terminal Information Processing System (TIPS) and the Consolidated Cab Display (CCD) equipments, how they would be installed at the Atlanta tower cab and TRACON, and how they could be integrated. The project study was sponsored by the FAA Systems Research and Development Service and conducted at the Atlanta tower cab and TRACON from October 1978 through September 1979.

The work was completed with the cooperation of the Southern Region of the FAA, in particular the Air Traffic Service (AAT) Division. The report was written by Paul Rempfer, Lloyd Stevenson and M. Stephen Huntley, Jr. of the Transportation Systems Center of the Research and Special Programs Administration.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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1. INTRODUCTION

This report presents an analysis of how the new Terminal Information Processing System (TIPS) and Consolidated Cab Display (CCD) might appear to Air Traffic personnel if they were installed in the Cab and TRACON at Hartsfield-Atlanta Airport. The CCD is a computer based system which will consolidate much of the weather sensor data (e.g., Runway Visual Range, Centerfield Wind), the equipment status indicators (e.g., Instrument Landing System, Approach Lighting System), and field lighting controls (e.g., Approach Lighting System, runway edge lights) into a single system. The system will have several display types and data entry devices but each device will be tailored to the specific needs of the associated controller. The TIPS is also a computer based system however, its primary objective is the replacement of ageing Flight Data Entry and Printout (FDEP) equipment. TIPS will provide each controller with a display and data entry device tailored to present flight data, and eliminate the need for FDEP and the associated flight progress strips. Both of these systems are just entering the prototype (for the CCD) and engineering model (for the TIPS) development stage. Therefore, this analysis is intended to provide information which can be used to improve the systems operational utility prior to operational deployment. In addition operational requirements for the integration of the two systems are considered.

The analysis approach centers around the preliminary design of the controller interfaces for both systems as tailored to the Hartsfield-Atlanta operation. The designs are based upon the specifications currently being used for the prototype and engineering model. They are tailored to the Hartsfield-Atlanta operation using data on the operation gathered during a cab and TRACON operations analysis.

The operations analysis results are presented in Sections 2 through 6 of the report. Section 2 presents an overview of the Atlanta terminal area/TRACON and Hartsfield-Atlanta Airport/tower cab operations. The section includes a map of the airport, a chart of the terminal area, the runway configurations and approach/departure routes used, drawings of the cab and TRACON floor plan, the definition of control positions, the principal duties for each control position, and the location of each control position in the cab and TRACON. In addition, a photograph of every controller work station is presented on which every display and control device is identified. Section 3 presents the operational characteristics of the displays and control devices which will be consolidated under the CCD. For each device the section presents a photograph, its locations in the Cab or TRACON, the users in the cab or TRACON, and how or for what the device is used. Section 4 presents the operation of the current FDEP and flight progress strip system. The section includes photographs of the flight progress strips at each controller station during a busy traffic period, a description of how the strips are used (including marking and manipulation) and estimates of the maximum number of strips which are likely to be found at each controller station. Section 5 presents the method by which the status of equipment is currently delivered to the controllers. The section covers all equipments, not just those equipments for which status will be automatically provided by the CCD prototype. This information may prove useful if the capabilities of the CCD are expanded. Section 6 presents the current weather distribution and utilization at the Atlanta Cab and TRACON.

In proceeding from the operations analysis to the preliminary system designs, each system was initially treated as completely independent of the other. This is, in fact, how the development programs are proceeding and how the specifications read. The CCD and the TIPS designs are presented in Sections 7 and 8, respectively. In Section 7 the CCD designs include scale drawings of the various controller interface devices to be provided, the display formats for each device, and, to some degree, how each format would be implemented via the CCD software system. Following the description of each device a subsection presents issues which might effect the operational acceptance of the device and assumptions beyond the specification which were needed to complete the designs. Section 7 ends with the assignment of CCD devices to each control station in the cab and TRACON. In Section 8 the TIPS designs include a scale drawing of the TIPS controller interface and example display formats for each type of control position (i.e., eleven control positions). Following the designs a subsection presents an assessment of how well TIPS will provide the flight status information currently available via flight progress strips and scratch pads. Section 8 ends with a summary of key issues resulting from the assessment.

Following the individual system designs, the equipments are studied as to their joint installation at each type of control position (i.e., the eleven positions selected for study in Section 8). The results of this study are given in Section 9. The results include drawings of how the equipments would be installed in each work station, issues as to the operational acceptability of the joint installation, and a discussion as to the operational requirement for the integration of the two systems. Section 9 completes this report.

In conducting the operations analysis at Hartsfield-Atlanta considerable cooperation was given by the Air Traffic and Airway Facilities personnel. In addition, 24 hours of controller interviews were conducted. However, it should be made clear that in conducting the preliminary equipment and installation designs and, in generating issues regarding their operational acceptability, neither Air Traffic nor Airway Facilities personnel were consulted. It was decided that the review of the designs and related issues with the local field personnel would be more appropriately done by the individual FAA project personnel since they are more familiar with their respective system. Therefore, preliminary designs presented in this report do not reflect field personnel inputs.

2. ATLANTA AIR TRAFFIC CONTROL SYSTEM

This section briefly surveys the general operational setting against which the Consolidated Cab Display and Terminal Information Processing systems are to be considered. The Atlanta Terminal Area is laid out and operated as shown in the following Figures and Tables.

- ° Terminal Area Layout (Figure 2-1)
- ° East Arrival Configuration
  - ° Typical Approach Pattern (Figure 2-2)
  - ° Typical Taxiway Traffic Pattern (Figure (2-3)
- ° West Arrival Configuration
  - ° Typical Approach Pattern (Figure 2-4)
  - ° Typical Taxiway Traffic Pattern (Figure 2-5)
- ° List of Airports in the Terminal Area and the Type of TRACON Service Provided Each Airport (Table 2-1)
- ° Terminal Control Area (TCA) Layout (Figure 2-6)
- ° Example Daily Traffic Levels/TRACON (Table 2-2)

The Atlanta Terminal Area has 4 arrival and 8 departure gates, contains a TCA, overlays 15 secondary airports of which 10 are regularly serviced by the Atlanta TRACON, and operates in 2 primary approach patterns - the East and West configuration. The primary airport within the terminal area is Hartsfield-Atlanta, which is the second busiest airport in the country. Hartsfield typically handles about 1700 operations per day. The operations form about 75% of the traffic typically handled by the Atlanta TRACON. The remainder of the TRACON traffic is made up of arrivals and departures to secondary airports and overflights passing through the terminal area.

The Atlanta TRACON is laid out and staffed as described in the following Figures and Tables.

- ° TRACON Positions-Staffing and Duties (Table 2-3)

- TRACON Layout (Figure 2-7)
- Photographic Survey of TRACON Positions (Figure 2-8 is the Assistant Chief's Position and proceeding clockwise around the TRACON layout to Figure 2-34 the Departure Handoff No. 1 Position)

There are 31 positions in the TRACON of which 20 positions are staffed on a daily basis. The TRACON is divided into the Arrival, Departure, and Satellite Walls. During the day, 2 teams of controllers are on duty in the TRACON - one team staffs the Arrival Wall positions and the other team mans the Departure/Satellite Wall positions. During the midnight shift, one team mans both the TRACON and Tower Cab and only the DR-1, DR-3, and DH-3 positions are staffed in the TRACON. During that time, these positions handle all the arrival,departure, and overflight traffic for the TRACON.

Similarly, the Hartsfield-Atlanta Tower Cab is laid out and staffed as described in the following Figures and Tables.

- Tower Cab Positions-Staffing and Duties (Table 2-4)
- Tower Cab Layout (Figure 2-40)
- Photographic Survey of Tower Cab Positions (Figure 2-41 is the Team Supervisor's position and the Figures proceed around the Tower Cab in a clockwise direction and end with the Clearance Delivery position in an island in the middle of the Cab shown in Figures 2-59 through 2-61)

There are 11 positions in the Tower cab of which 9 are staffed on a daily basis and consist of

- Team Supervisor
- Cab Coordinator
- (3) Local Control Positions
- (2) Ground Control Positions
- Clearance Delivery
- Flight Data

Whenever the Cab Coordinator is required, the Team Supervisor tends to stand the position himself; a common practice at Atlanta in both the cab and TRACON. During most of the day there are 3 local controllers on duty - one for each of the airport's 3 runways. The 2 ground controllers split traffic based on the side of the Terminal Gate Area out of which the flights operate - the east side operations are handled by GC-2 and the west side operations by GC-3. Clearance Delivery is staffed 24 hours a day while flight Data is staffed only during the departure peaks.

TABLE 2-1. ATLANTA TRACON CONTROLLED AIRPORTS

ATLANTA TERMINAL AREA AIRPORTS	ANNUAL INSTRUMENT OPERATIONS (FY77)
Primary Airport	
Hartsfield-Atlanta International (ATL)	526,916 (82%)
Secondary Towered Airports	
Charlie Brown County (FTY)	32,545 (5%)
Dekalb Peachtree (PDK)	37,150 (6%)
Dobbins Air Force Base (MGE)	-
Non-Towered Airports Provided Approach/Departure Radar Service by ATL TRACON	43,183 (7%)
Cartersville (6A0)	
Covington Muni (9A1)	
Falcon Field (2A9)	
Griffin Spalding Co (6A2)	
Gwinnett Co (17A)	
Newnan Coweta Co (CCO/9A8)	
West Georgia Regional (CTJ/2A3)	
Non-Towered Airports Not Provided Approach/Departure Radar Service by ATL TRACON	
Bear Creek (4A7)	
Berry Hill (4A0)	
McCollum (8A4)	
South Expressway (9A7)	
Stone Mountain (00A)	
	639,794

TABLE 2-2. ATLANTA TRACON TRAFFIC LEVEL FOR AN EXAMPLE VFR AND IFR WEEKDAY

	OPERATIONS			
	10/19/78 VFR CONDITIONS		12/4/78 IFR CONDITIONS	
IFR OPERATIONS				
HARTSFIELD-ATLANTA				
Air Carrier	1407		1441	
Air Taxi	45		33	
General Aviation	160		111	
Military	25		15	
Sub-Total	1637	(73%)	1600	(78%)
SECONDARY AIRPORT	303	(14%)	300	(15%)
OVERFLIGHTS	12	(0%)	8	(0%)
TOWER EN ROUTE CONTROL	56	(2%)	98	(5%)
IFR SUB-TOTAL	2008	(89%)	2006	(98%)
TCA OPERATIONS				
HARTSFIELD-ATLANTA	76	(3%)	7	(0%)
OVERFIGHTS	152	(7%)	4	(0%)
TCA SUB-TOTAL	228	(10%)	11	(0%)
OTHER	7	(0%)	25	(1%)
TOTAL	2243	(99%)	2042	(99%)

TABLE 2-3. ATLANTA TRACON POSITIONS - STAFFING AND DUTIES

POSITIONS	TYPICAL STAFFING (LOCAL TIME)	SUMMARY OF PRIMARY DUTIES
Terminal Arrival Control Function		To Control/Merge IFR Filed & TCA Filed Arrivals To Hartsfield-Atlanta Prior to ILS Turn-On. Arrivals Enter The Terminal Area Through 4 Arrival Gates (Figure 2-1)
TAR-1	Not Currently Staffed	
TAR-2	0800 to 2400 With Breaks	Services Arrivals From the 2 Northern Gates
TAR-3	0800 to 2400	Services Arrivals From The 2 Southern Gates/ Combined TAR Position
TAR-4	Not Currently Staffed	
Final Control Function		To Control Arrivals To Hartsfield-Atlanta During Turn-On To The ILS Localizer Prior to Handoff To Local Control
AR-1	0800 to 2400	Services Arrivals To Runways 9R/27L & 9L/27R/ Combined AR Position
AR-2	0800 to 2400 With Breaks	Services Arrivals To Runway 8/26
Monitor Function		To Monitor Separation Between Parallel Arrivals On Final Approach When Simultaneous Parallel ILS Approaches Are In Progress And IFR Separations on Final Approach Are To Be Maintained; Communicate On the AR Frequencies
MON-1	Typical Staffed 5 Out of 7 Days For 8 Out Of The 16 Hour Day 0800-2400	Services Arrivals On Final Approach To Runway 9R/27L
MON-2		Services Arrivals on Final Approach To Runway 8/26
Departure Control Function		To Control (1) IFR Filed/TCA Filed Departures From Hartsfield After Their Initial Climb (2) IFR Filed Turbojet Departures From Satellite Airports (3) IFR Filed/TCA Filed Overflights (4) IFR Filed Arrivals At 6000 Ft. Approaching Hartsfield From Downwind Side Departures Exit the Terminal Area Through 8 Departure Gates (Fig. 2-1)

TABLE 2-3. ATLANTA TRACON POSITIONS - STAFFING AND DUTIES (Cont'd)

POSITIONS	TYPICAL STAFFING (LOCAL TIME)	SUMMARY OF PRIMARY DUTIES
Departure Control Fundtion (Cont'd)		
DR-1	24 Hrs/Day	Services Departures to South and East/During Mid-night Shift Takes On TAR-3 & AR-1 Functions
DR-2	Not Currently Staffed	
DR-3	24 Hrs/Day	Services Departures To North And West/During Mid-night Shift Takes on TAR-2 & AR-2 Functions
DR-4	Not Currently Staffed	
Satellite Control Function		To Control (1) IFR Filed Arrivals/Departures At Satellite Airports (2) Propeller Driven Departures From Hartsfield-Atlanta (3) IFR Filed Overflights Passing Beneath the TCA Satellite Airspace Consists Of Most Of The Air-Space Below And Outside The TSC (Figure 2-6)
SAT-1	0800 to 2400	Services Airports/Airspace In Northeast Quadrant of Terminal Area
SAT-2	0800 to 2200	Services Airports/Airspace In Northwest Quadrant of Terminal Area
SAT-3*[1]	0800 to 2200 With Breaks	Services Airports/Airspace In The 2 Southern Quadrants of Terminal Area and Handles Most Propeller Driven Departures From Hartsfield-Atlanta

*[1] When SAT-3 Not Staffed, SAT-1 Controls The 2 Eastern Quadrants and SAT-2 Controls The 2 Western Quadrants

TABLE 2-3. ATLANTA TRACON POSITIONS - STAFFING AND DUTIES (Cont'd)

POSITIONS	TYPICAL STAFFING (LOCAL TIME)	SUMMARY OF PRIMARY DUTIES
Handoff Function		To Support The Radar Positions In Terms Of Posting Flight Strips, Taking TELCO Calls, And Performing ARTS Keyboard Functions
Arrival		
AH-1	Not Currently Staffed	
AH-2	0800 to 2200 With Breaks	Supports TAR-2
AH-3	0800 to 2400	Supports TAR-3
AH-4	Not Currently Staffed	
Depature		
DH-1	Not Currently Staffed	
DH-2	Not Currently Staffed	
DH-3	Typically Staffed 5 Out Of An 8 Hour Shift	Supports DR-1 And DR-3/During Midnight Shift Takes On The AH-2, AH-3, SATH-1, SATH-2, SATH-3 Functions
DH-4	Not Currently Staffed	
Satellite		
SATH-1	0800 to 2400	Supports SAT-1 And Handles FDEP At Position
SATH-2	0800 to 2200	Supports SAT-2
SATH-3	0800 to 2200 With Breaks	Supports SAT-3
Coordinator Function		To Direct And Coordinate The TRACON Services
CI-A (North)	Not Currently Staffed	Coordinates The Hartsfield-Atlanta Arrival Services Typically Staffed by the Arrival Team Supervisor
CI-A (South)	During 0800-2400 Generally Staffed 12 Out of 16 Hours	
CI-D	Not Normally Staffed	If Staffed, The Positions Are Combined And Staffed By the Departure/Satellite Team Supervisor
CI-SAT	Not Normally Staffed	
Team Supervisor Function		To Direct His Crew Of Controllers And To Supervise The Operation For Which His Crew Is Responsible. From 0800 to 2400 There Are Two Crews On Duty In The TRACON and from 0000 to 0800 There Is Only One Crew On Duty

TABLE 2-3. ATLANTA TRACON POSITIONS - STAFFING AND DUTIES (Cont'd)

POSITIONS	TYPICAL STAFFING (LOCAL TIME)	SUMMARY OF PRIMARY DUTIES
Team Supervisor Function (Cont'd)		
Arrival TS	0800 to 2400*[2]	Supervises The Atlanta Arrival Operation Including Flow Control
Departure/Satellite TS	0800 to 2400	Supervises The Atlanta Departure And Satellite Airport Operations
Assistant Tower Chief Function (AC)	0800 to 2400	Supervises The Tower Cab/TRACON Operation/ Responds To Equipment Outages And Performs Out Of TRACON Coordination

*[2] From 0000 to 0800, One TS/Crew Handles Both the TRACON And Tower Cab Including The Assistant Tower Chief's Function

TABLE 2-4. HARTSFIELD-ATLANTA TOWER CAB POSITIONS - STAFFING AND DUTIES

POSITION	DESIG-NATION	TYPICAL STAFFING	PRIMARY FUNCTIONS
TEAM SUPERVISOR	TS	0800-2400*[1]	Directs His Crew Of Controllers And Supervises The Operation For Which His Crew Is Responsible
CAB COORDINATOR	CC	0800-2400 With Breaks	Directs/Coordinates Local Control Services; generally staffed by the Team Supervisor
LOCAL CONTROL FUNCTION			Controls Aircraft In Vicinity Of The Airport And Onto And Off Of The Runway
LOCAL CONTROL-1	LC-1	Staffed About 12 Out Of 24 Hrs	Services Arrivals/Departures On Runway 9R/27L (Primarily an Arrival Runway) and Crosses Traffic Over Runway 9L/27R
LOCAL CONTROL-2	LC-2	24 Hrs/Day With Breaks	Services Arrivals/Departures on Runway 9L/27R (Primarily Used As A Departure Runway)
LOCAL CONTROL-3	LC-3	24 Hrs/Day	Services Arrivals/Departures on Runway 8/26 (Used As An Arr./Dep. Runway). It Also Serves As The Combined Local Control Position
LOCAL CONTROL-4	LC-4	Not Currently Staffed	
GROUND CONTROL FUNCTION			Controls Aircraft And Ground Vehicles On The Taxiways
GROUND CONTROL-1	GC-1	About Once A Week	Services Arrivals While They Are South Of Runway 8/26
GROUND CONTROL-2	GC-2	24 Hrs/Day	Services Arrivals To/Departures From the East Side Of The Terminal. It Serves As The Combined Ground Control Position
GROUND CONTROL-3	GC-3	0600-0200	Services Arrivals To/Departures From The West Side Of The Terminal

*[1] From 0000-0800, One TS/Crew Handles Both The TRACON And Tower Cab - The TS Remains In The TRACON

TABLE 2-4. HARTSFIELD-ATLANTA TOWER CAB POSITION - STAFFING AND DUTIES (Cont'd)

POSITION	DESIG-NATION	TYPICAL STAFFING	PRIMARY FUNCTIONS
FLIGHT DATA	FD	Dep. Peaks - 4 Hrs/Day	Receives, Posts, And Forwards Flight Data Concerning IFR Filed Departures
CLEARANCE DELIVERY	CD	24 Hrs/Day	Transmits IFR Clearances To Departures From Hartsfield-Atlanta. Takes On FD Function When That Position Is Not Staffed

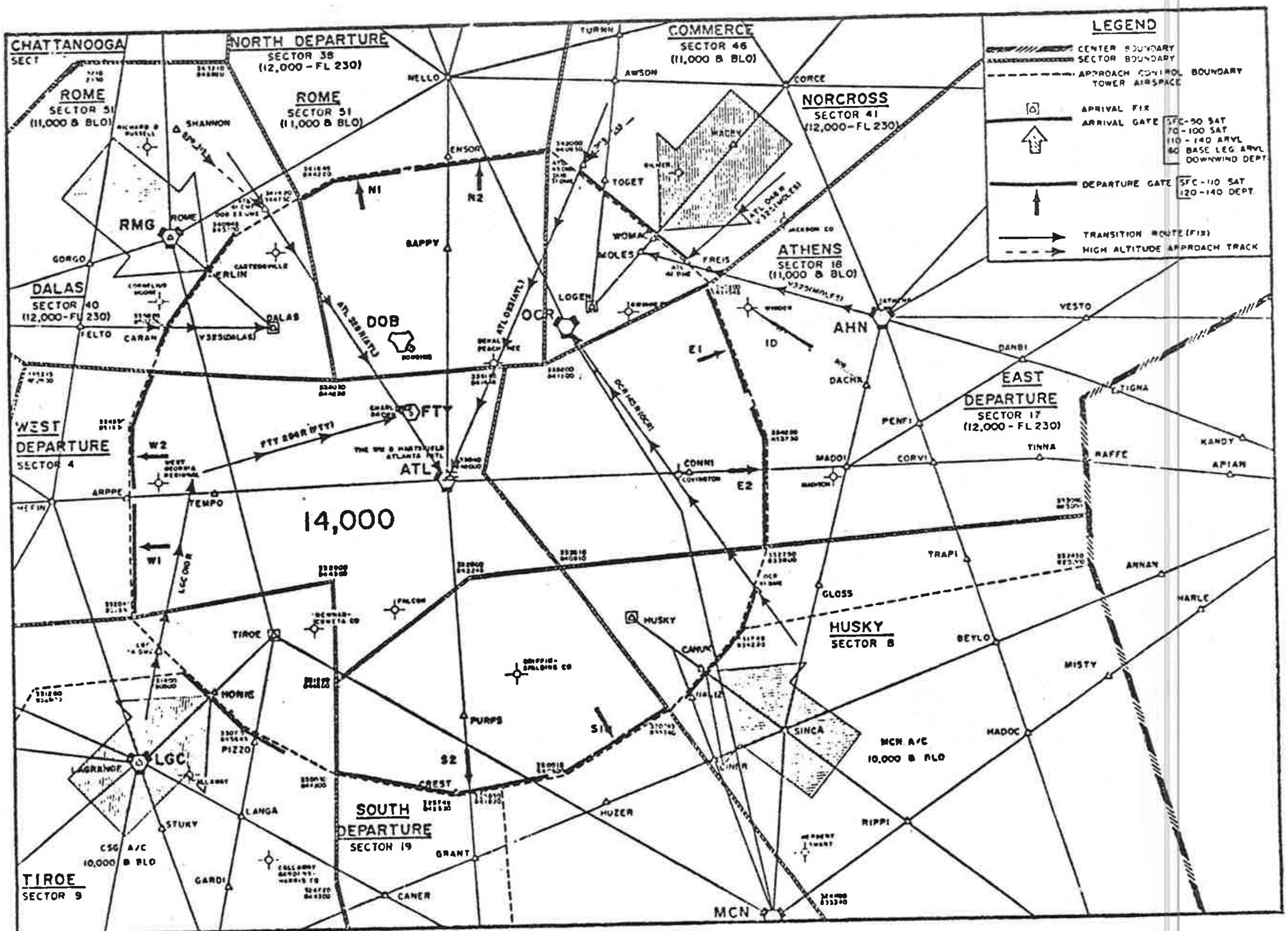


FIGURE 2-1. ATLANTA TERMINAL AREA

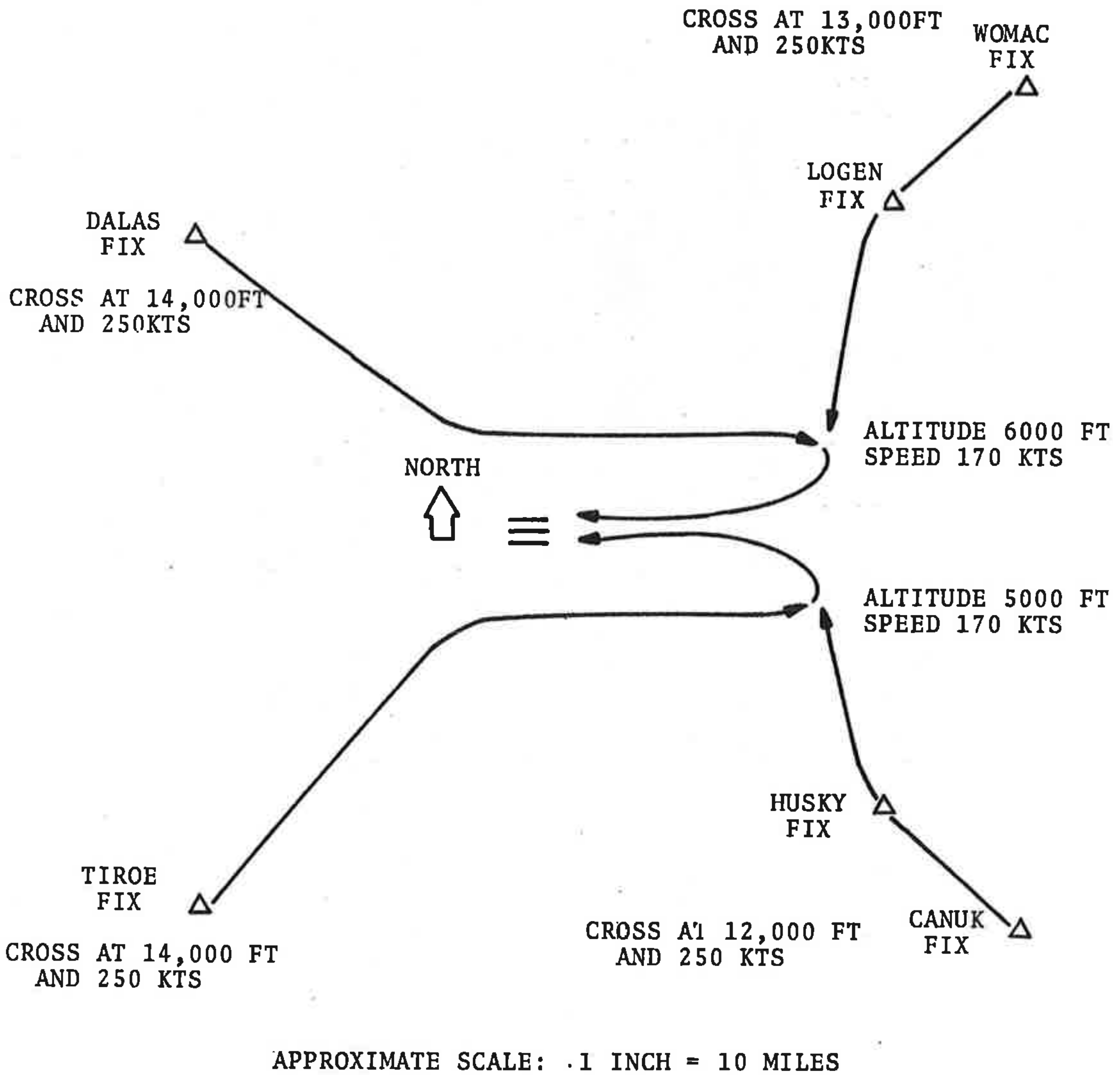
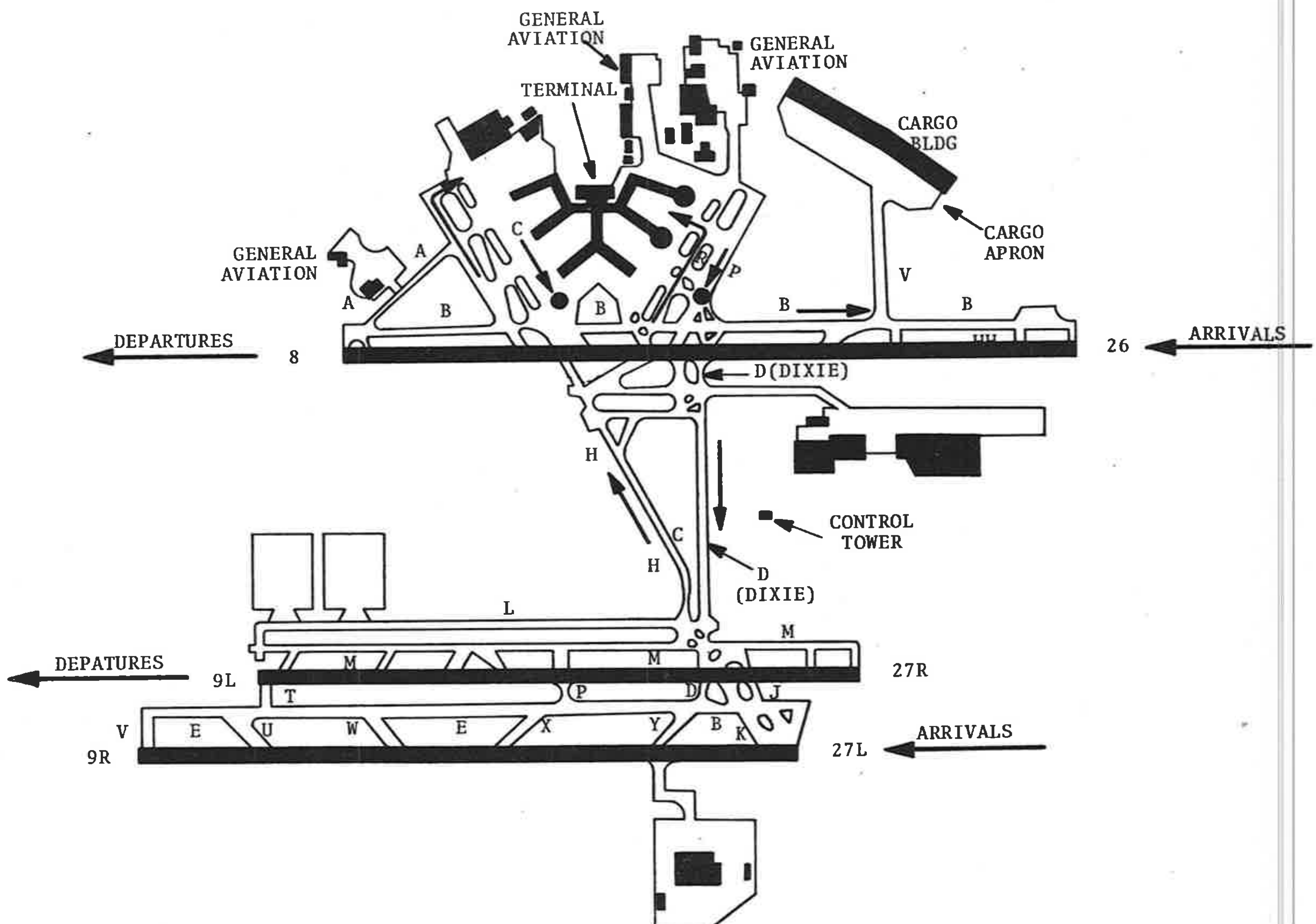


FIGURE 2-2. TYPICAL APPROACH PROFILE TO HARTSFIELD-ATLANTA FOR ARRIVALS FROM THE EAST RUNWAY CONFIGURATION (ARRIVAL RUNWAYS 26/27L)



● HOLD POINT FOR DEPARTURES AWAITING TAXI INSTRUCTIONS FROM GROUND CONTROL

FIGURE 2-3. TYPICAL TRAFFIC FLOW PATTERN AT HARTSFIELD-ATLANTA FOR THE EAST ARRIVAL CONFIGURATION

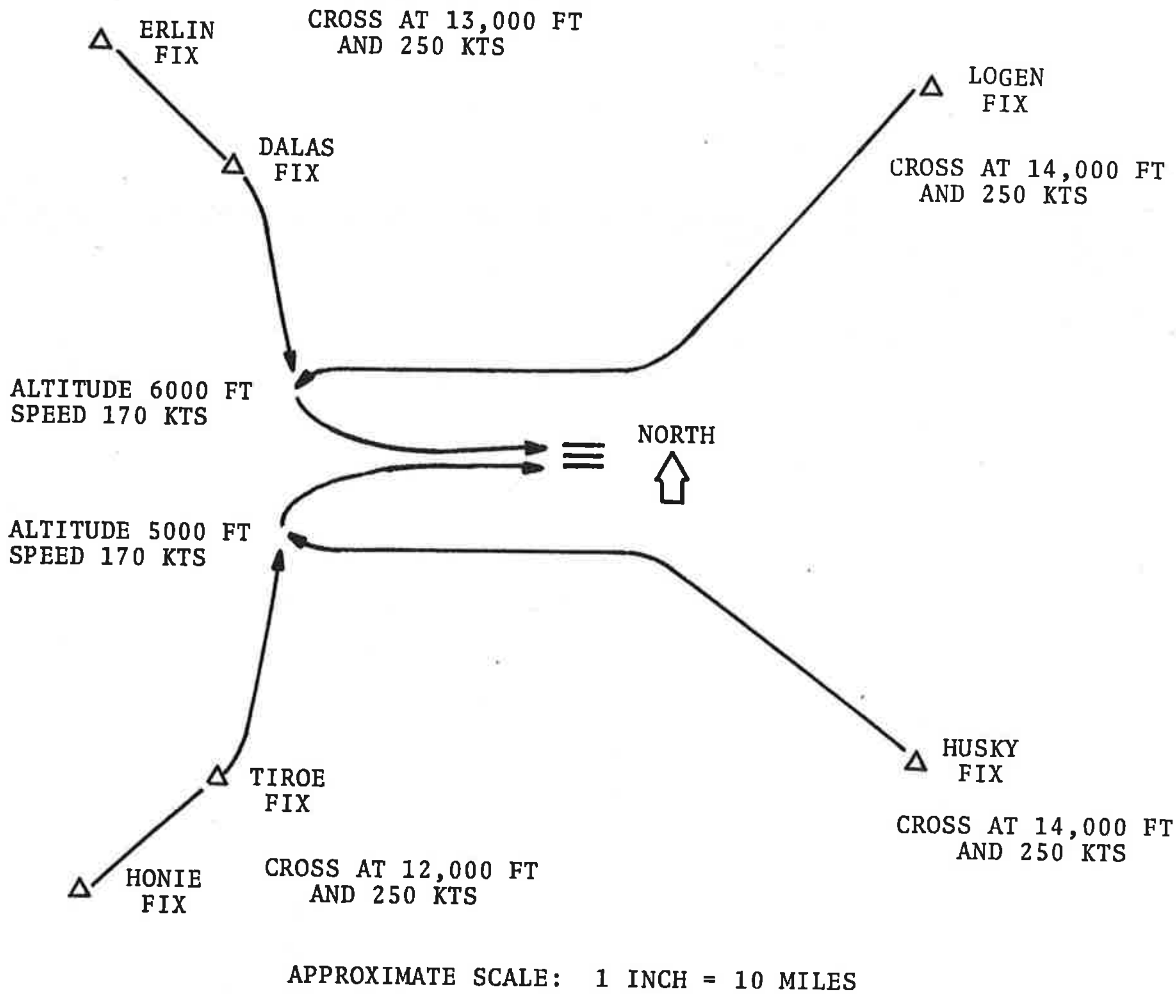
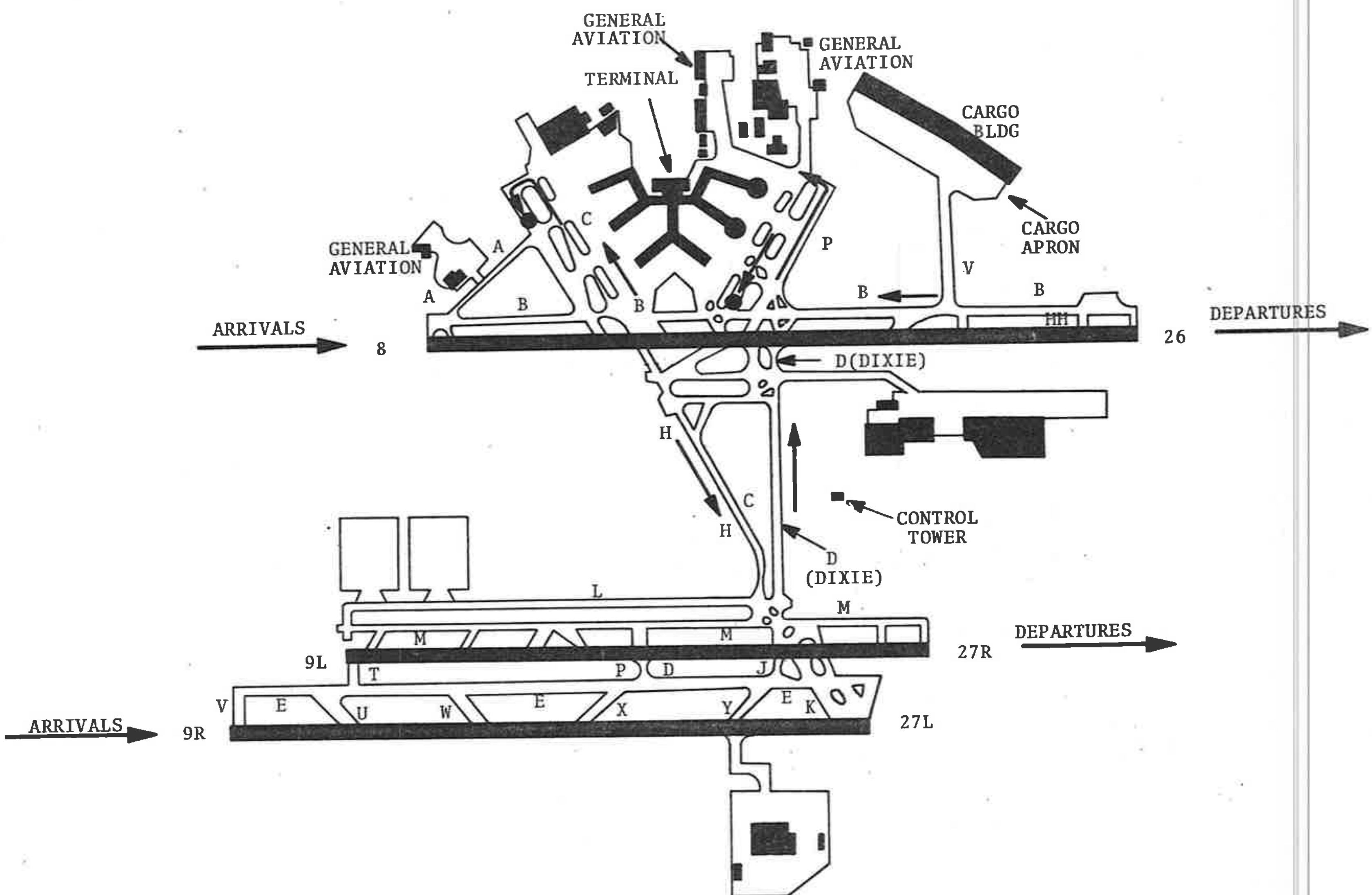
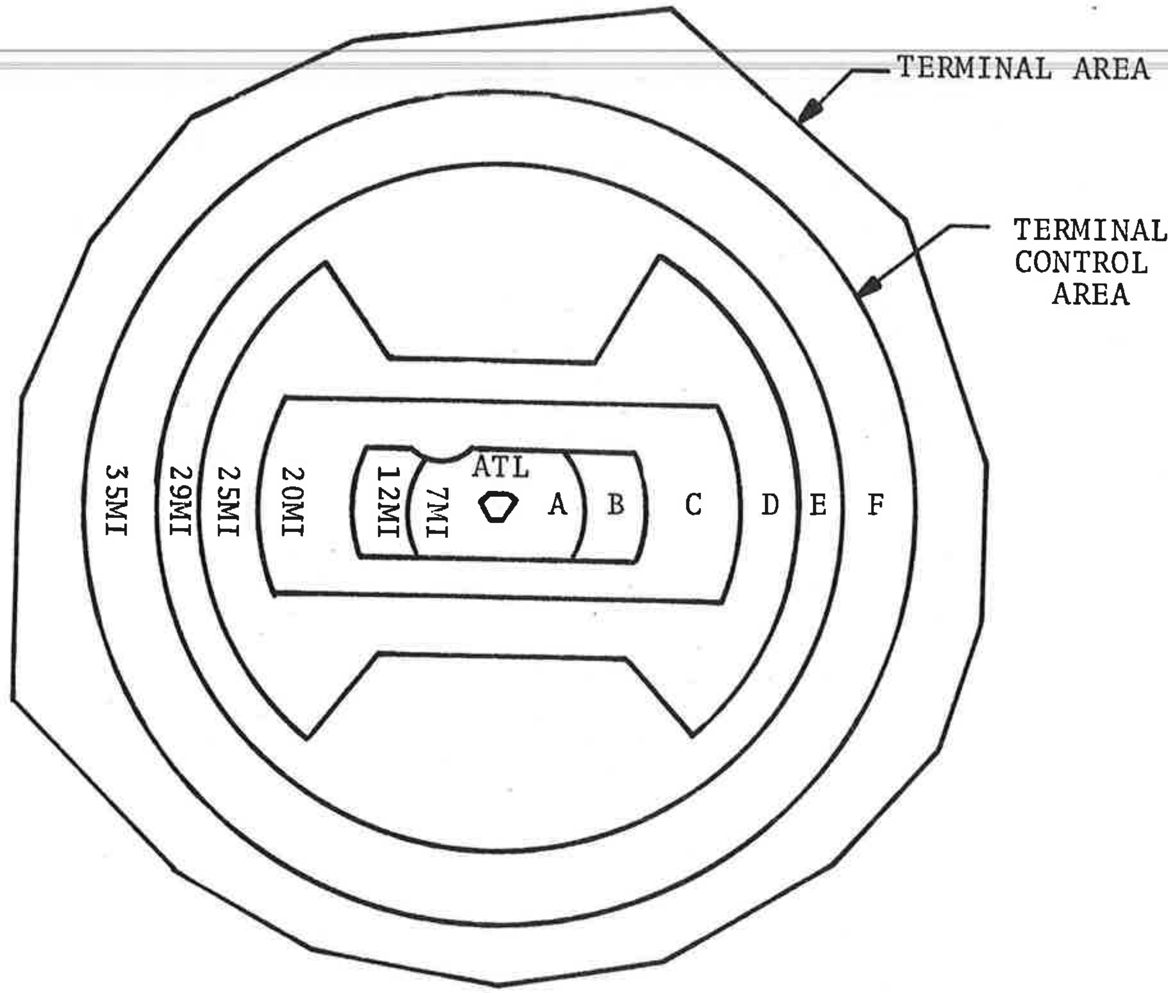


FIGURE 2-4. TYPICAL APPROACH PROFILE TO HARTSFIELD-ATLANTA FOR THE ARRIVALS FROM THE WEST RUNWAY CONFIGURATION (ARRIVAL RUNWAYS 8/9R)



● HOLD POINT FOR DEPARTURES AWAITING TAXI INSTRUCTIONS FROM GROUND CONTROL

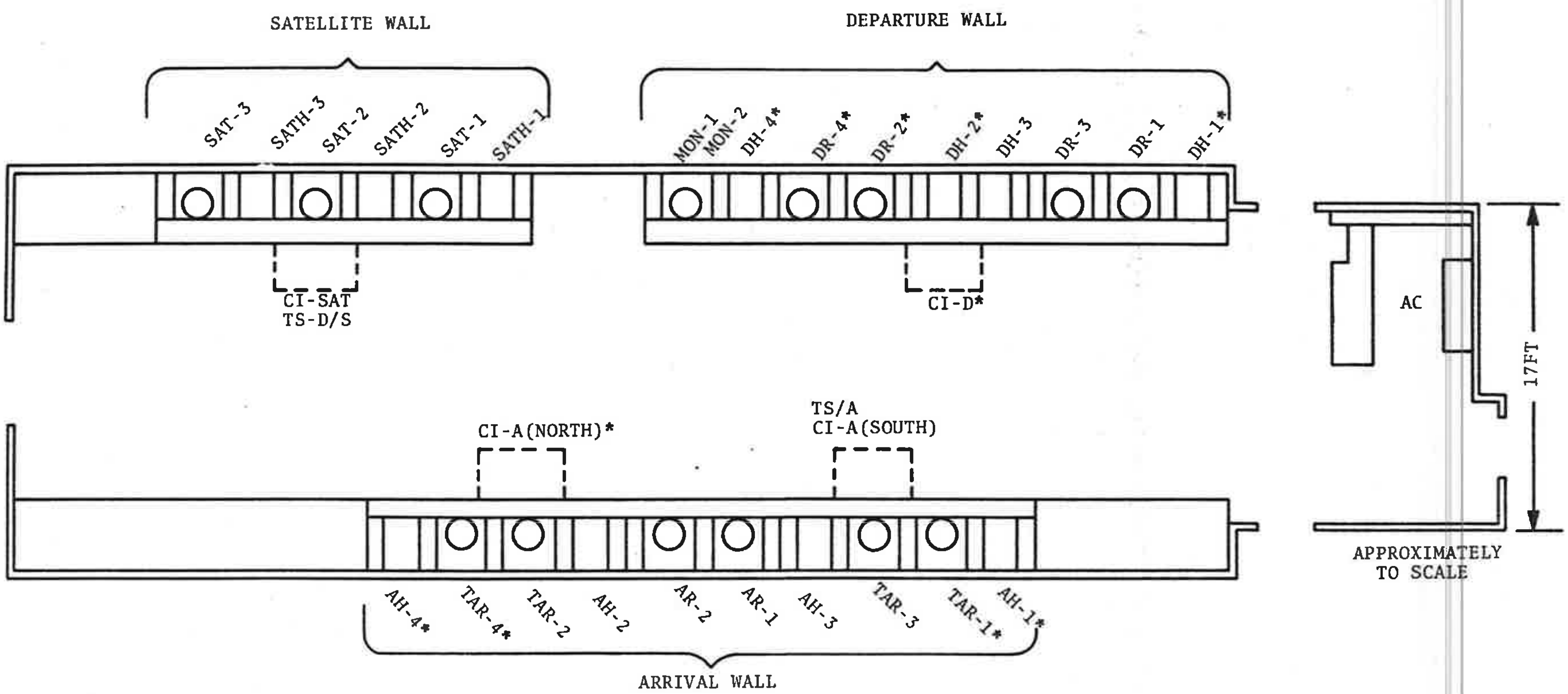
FIGURE 2-5. TYPICAL TRAFFIC FLOW PATTERN AT HARTSFIELD-ATLANTA FOR THE WEST ARRIVAL CONFIGURATION



TCA SECTOR ALTITUDES

A 12,500/GROUND
B 12,500/2,500
C 12,500/3,500
D 12,500/6,000
E 12,500/8,000
F 12,500/10,000

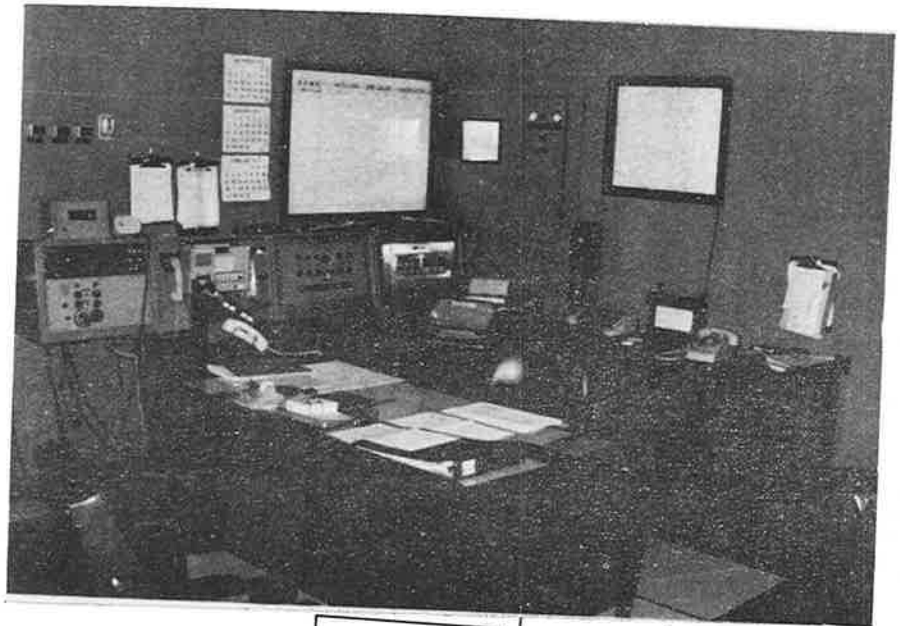
FIGURE 2-6. ATLANTA TERMINAL CONTROL AREA (TCA)

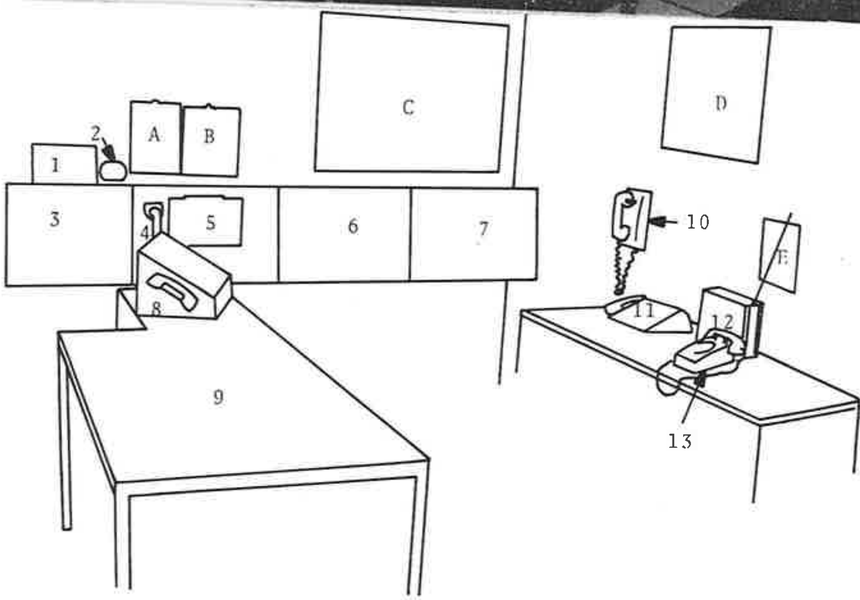


AC	ASSISTANT CHIEF
AH	ARRIVAL HANDOFF
AR	FINAL CONTROL
CI-A (NORTH)	COORDINATOR/NORTHERN ARRIVALS
CI-A (SOUTH)	COORDINATOR/SOUTHERN ARRIVALS
CI-D	COORDINATOR/DEPARTURES
CI-SAT	COORDINATOR/SATELLITE OPERATIONS
DH	DEPARTURE HANDOFF
DR	DEPARTURE RADAR CONTROL
MON	PARALLEL APPROACH MONITOR
SAT	SATELLITE AIRPORT CONTROL
SATH	SATELLITE HANDOFF
TAR	TERMINAL APPROACH RADAR CONTROL
TS-A	TEAM SUPERVISOR-ARRIVALS
TS-D/S	TEAM SUPERVISOR-DEPARTURES/SATELLITE

*POSITION NOT STAFFED ON A DAILY BASIS

FIGURE 2-7. ATLANTA TRACON LAYOUT

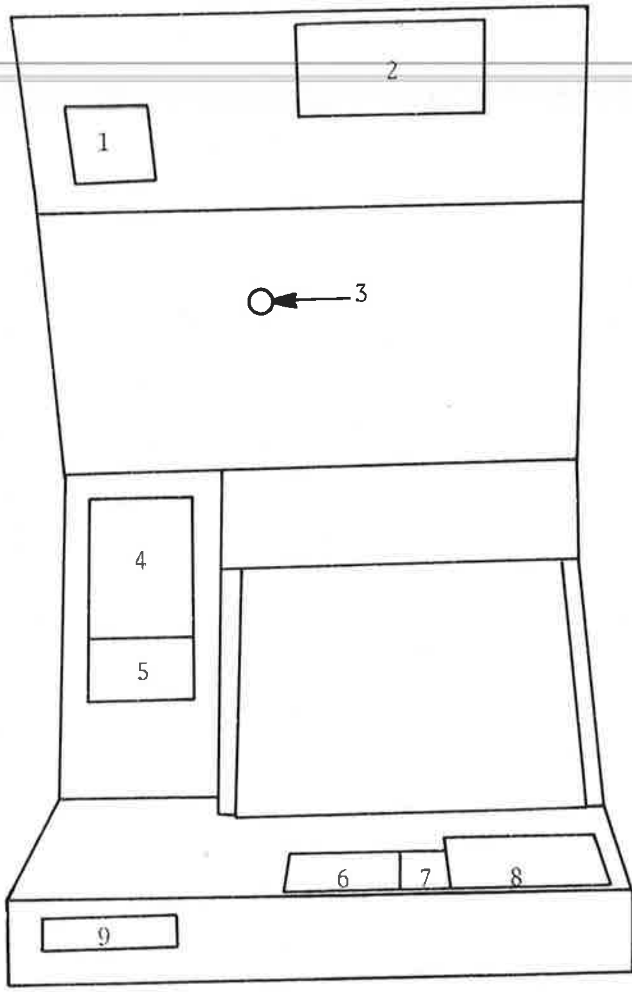


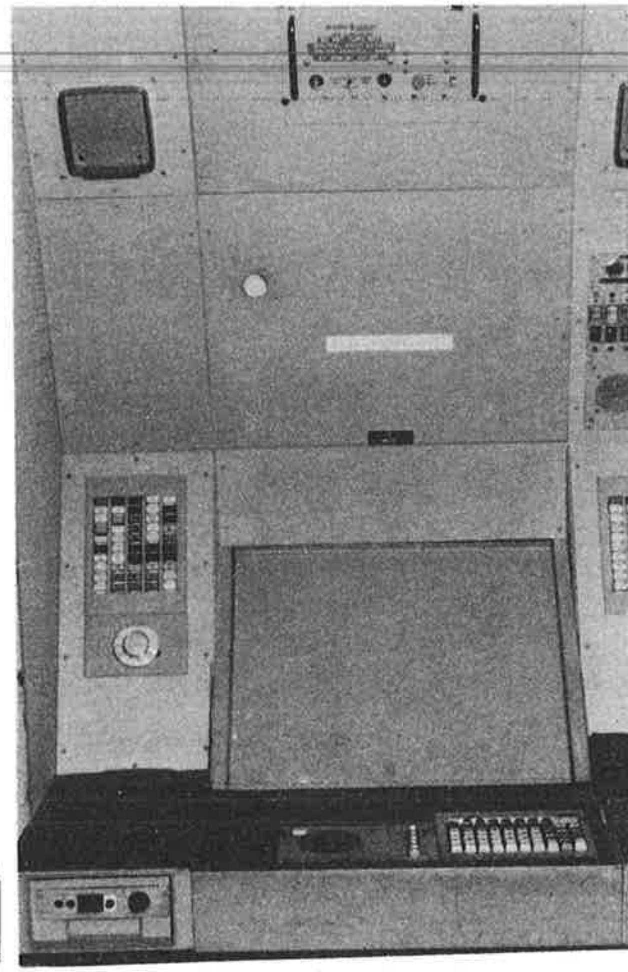


DEVICES
1 DIGITAL CLOCK
2 PENCIL SHARPENER
3 REX VORTAC CONTROL/MONITOR PANEL
4 CENTRAL FLOW CONTROL PANEL PLUS ELEVATOR ALARM/TELCO POWER STATUS
5 DOOR INTERCOM
6 DOOR MONITOR PANEL
7 FIRE ALARM PANEL
8 TELCO UNIT
9 SUPERVISOR'S DESK
10 PHONE TO CENTRAL FLOW CONTROL
11 PHONE TO OUTSIDE
12 AIRPORT OPS SUPERVISOR'S RADIO-PHONE
13 INTERCOM PHONE

POSTED PAPER WORK (OFF DESK)
A AIRCRAFT WITH EQUIPMENT WAIVERS THAT CAN OPERATE AT ATLANTA
B NOTAMS
C TRAINING STATUS
D AIRPORT MAP
E MENUS (LOCAL RESTAURANTS)

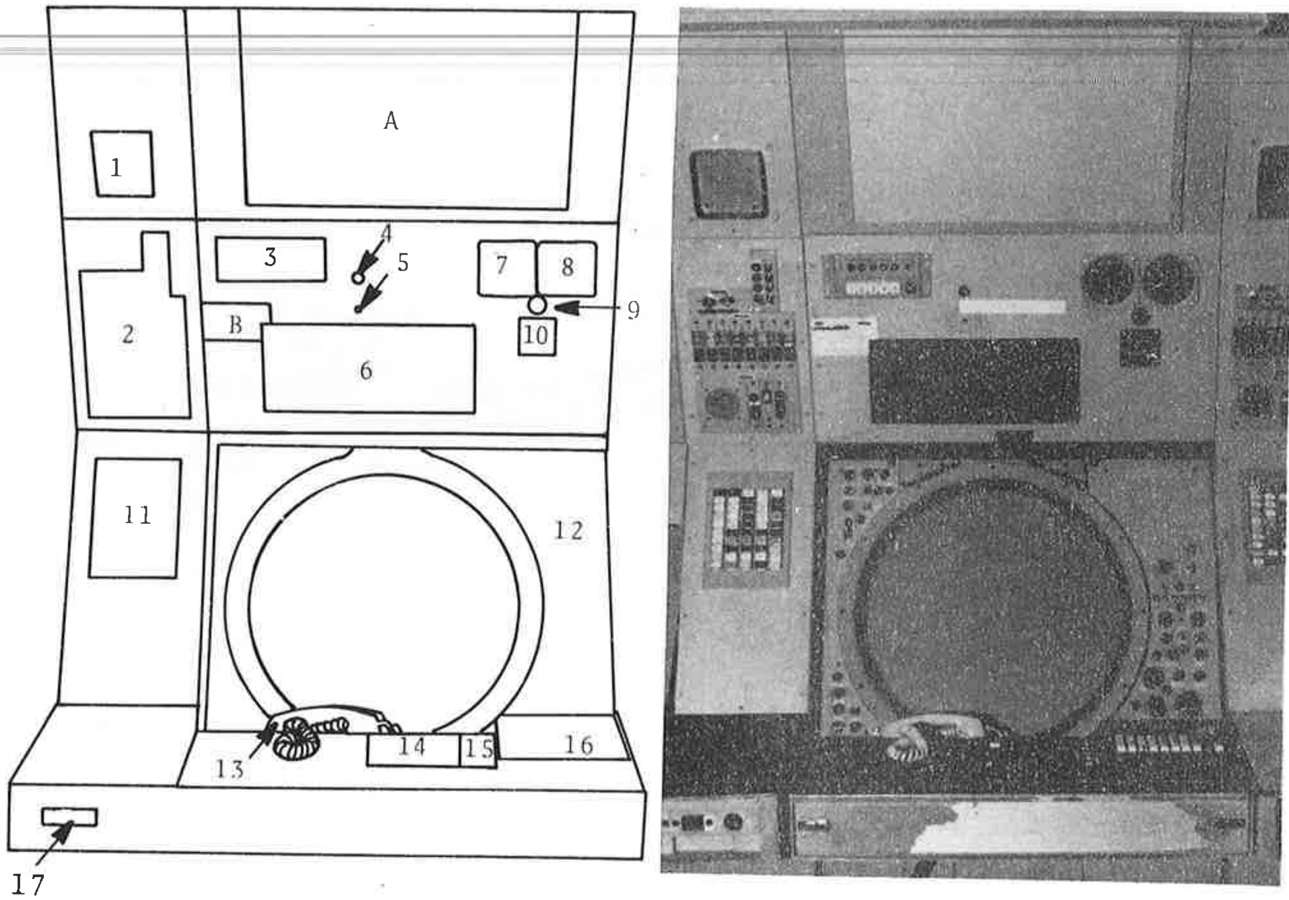
FIGURE 2-8. ASSISTANT TOWER CHIEF'S (AC) POSITION LAYOUT





DEVICES
1 TELCO SPEAKER
2 AURAL ALARM CONTROL
3 HALO LIGHT CONTROL
4 TELCO KEYPACK
5 TELCO DIAL BOX
6 ARTS TRACKBALL
7 ARTS QUICK LOOK PANEL
8 ARTS KEYBOARD
9 PHONE JACK

FIGURE 2-9. AH-1 (ARRIVAL HANDOFF) POSITION LAYOUT



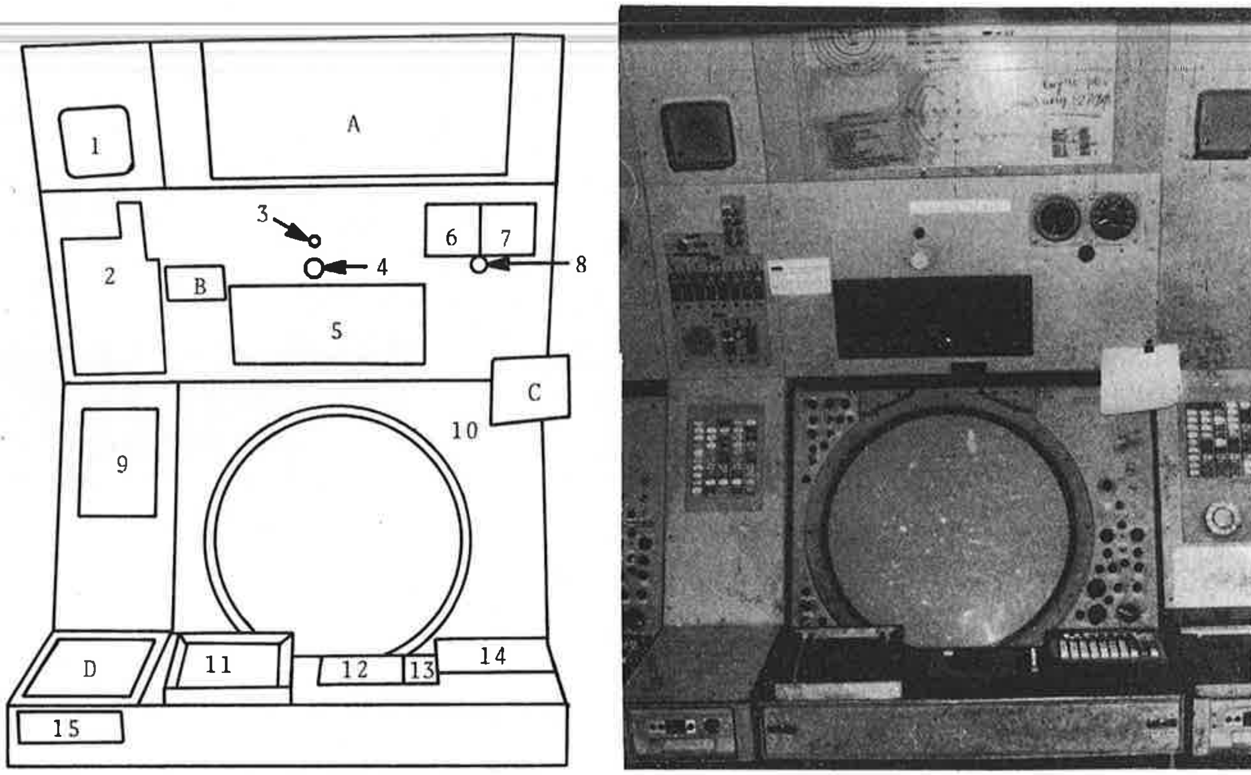
DEVICES

1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 VIDEO MAP SELECTOR
4 BACKLIGHT CONTROL FOR ITEM A
5 RHEOSTAT FOR HALO LIGHT
6 RVR PANEL
7 WIND DIR. INDICATOR
8 WIND SPEED INDICATOR
9 RHEOSTAT FOR WIND INSTRUMENTS
10 DIGITAL ALTIMETER
11 TELCO KEY PACK
12 ARTS PLAN VIEW DISPLAY/CON
13 HAND PHONE
14 ARTS TRACKBALL
15 ARTS QUICK LOOK PANEL
16 ARTS KEYBOARD
17 PHONE JACK

POSTED PAPER WORK

A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B COMMUNICATION INSTRUCTIONS

FIGURE 2-10. TAR-1 (TERMINAL AREA RADAR) POSITION LAYOUT



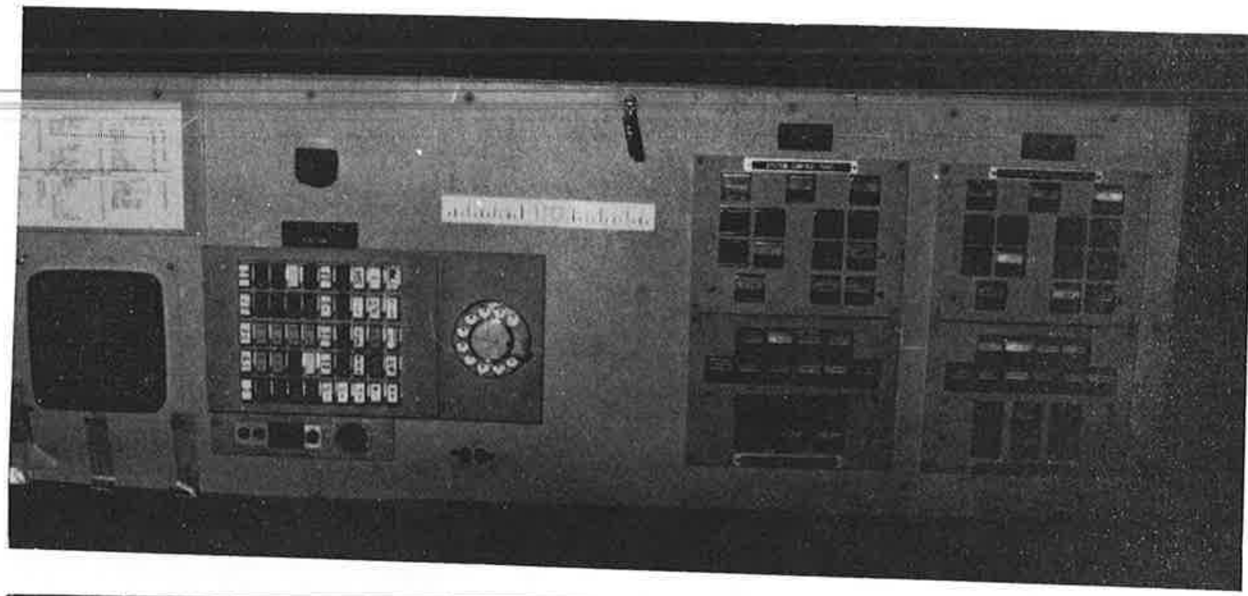
DEVICES

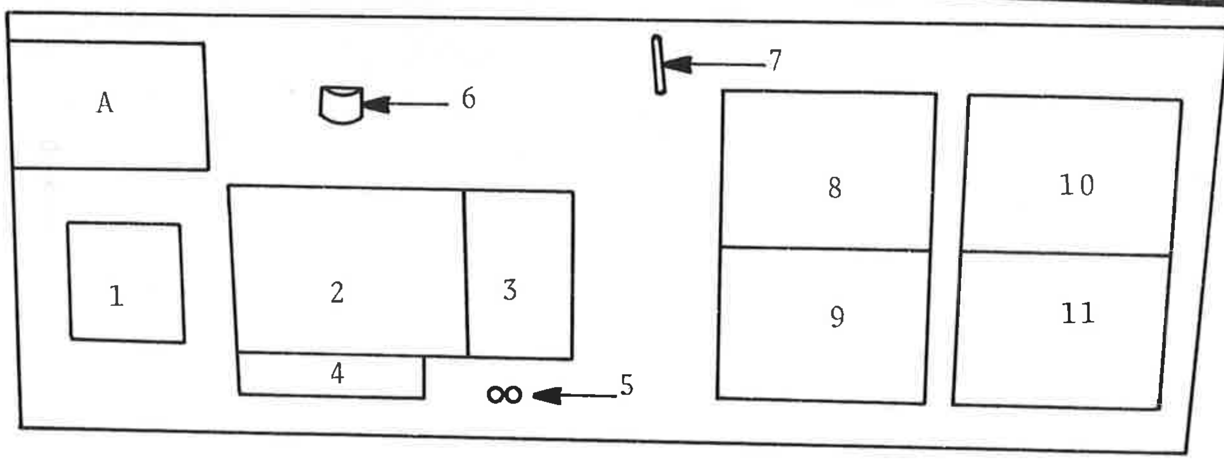
1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 RHEOSTAT FOR ITEM A BACKLIGHT
4 RHEOSTAT FOR HALO LIGHT
5 RVR PANELS
6 WIND DIR. INDICATOR
7 WIND SPEED INDICATOR
8 RHEOSTAT FOR WIND INSTR.
9 TELCO KEY PACK
10 ARTS PLAN VIEW DISPLAY/CONTROL
11 PORTABLE FLT. STRIP TRAY
12 ARTS TRACKBALL
13 ARTS QUICK LOOK PANEL
14 ARTS KEYBOARD
15 PHONE JACK

POSTED PAPERWORK

A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B COMMUNICATION INSTRUCTIONS
C ATLANTA HARTSFIELD AIRPORT WEATHER
D ARRIVAL AIRSPACE ALLOCATION CHARTS

FIGURE 2-11. TAR-3 (TERMINAL ARRIVAL RADAR) POSITION LAYOUT





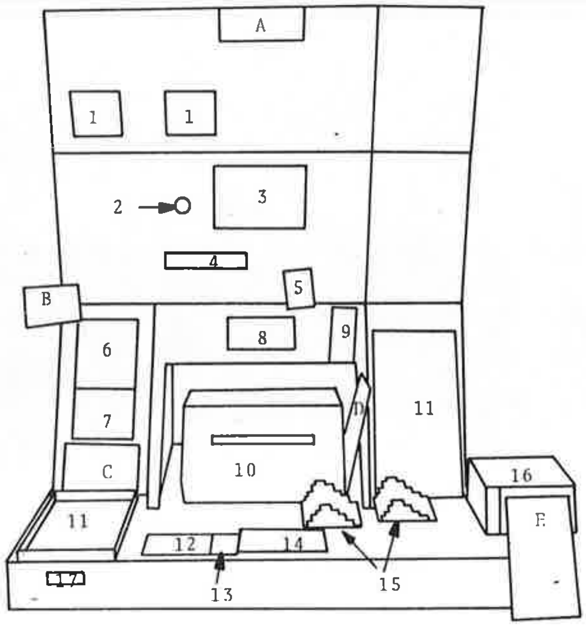
DEVICES

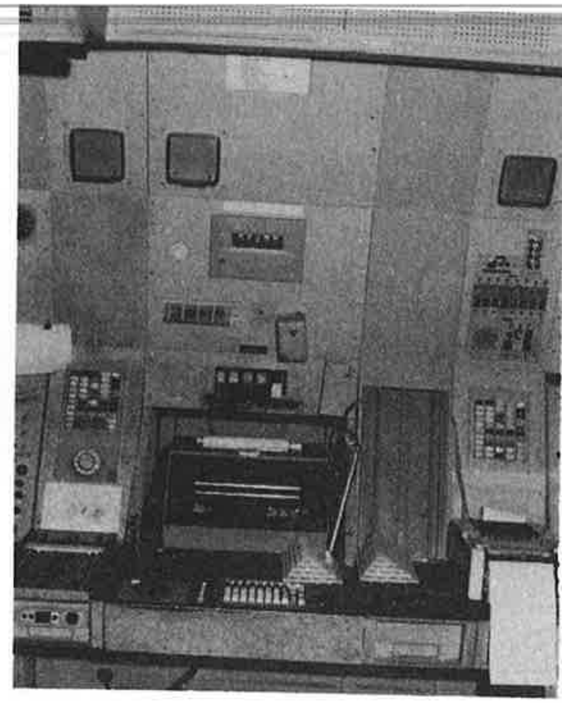
1 TELCO SPEAKER
2 TELCO KEYPACK
3 TELCO DIAL BOX
4 PHONE JACK
5 MAINT. PHONE JACK
6 INCOMING CALL LIGHT
7 PHONE CORD HOOK
8 RADIO MICROLINK CONTROL PANEL
9 " " " "
10 LAND LINE CONTROL PANEL
11 " " " "

POSTED PAPER WORK

A TELEPHONE DIAL CODES

FIGURE 2-12. CI - SOUTH ARRIVALS POSITION LAYOUT

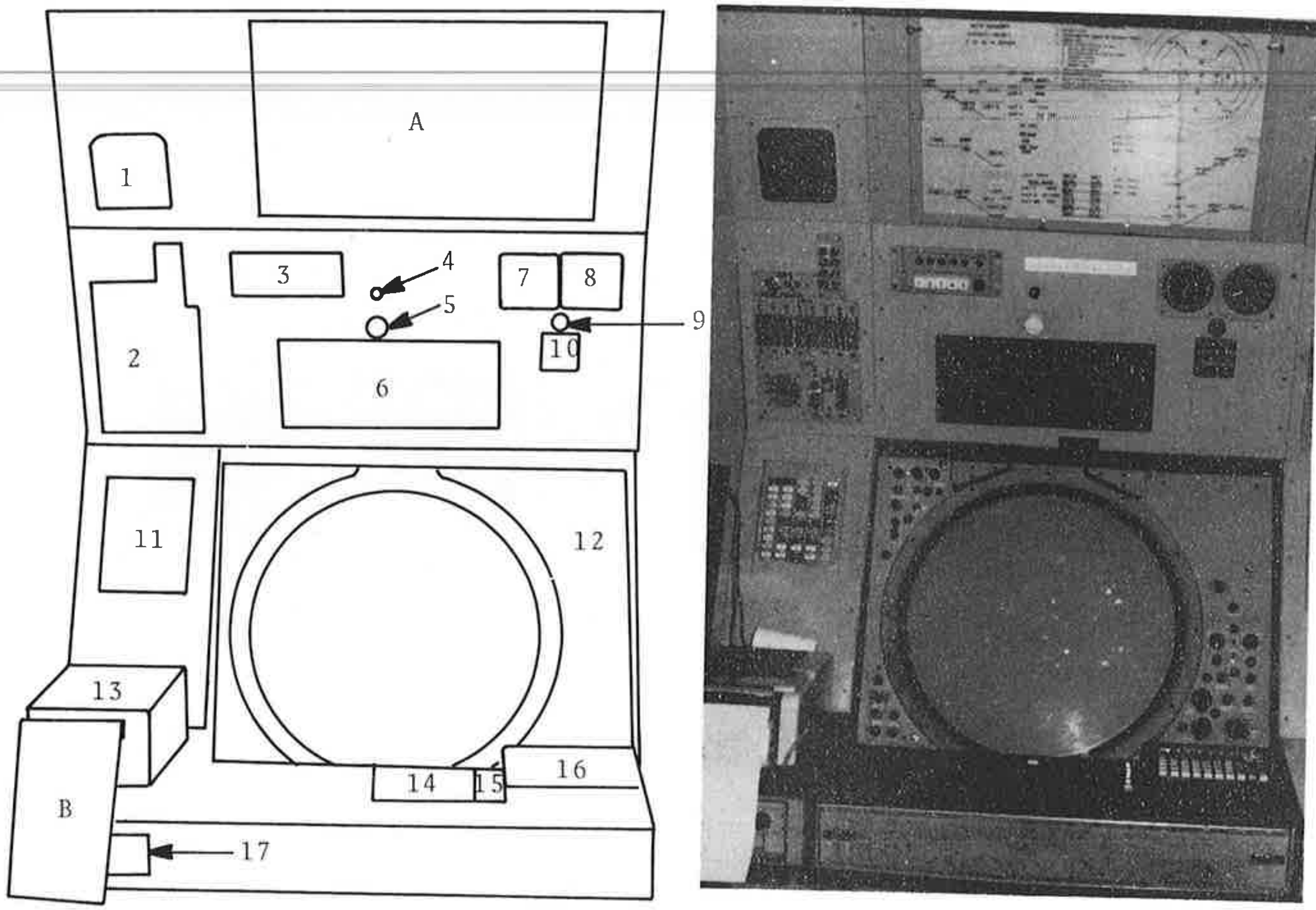




DEVICES
1 TELCO SPEAKER
2 HALO LIGHT CONTROL
3 DIGITAL CLOCK
4 FORMER FEED SLOT FOR ITEM 16
5 ELECTRO WRITER ALERT
6 TELCO KEYPACK
7 TELCO DIAL BOX
8 FLT. STRIP STORAGE BIN
9 PEN HOLDER
10 FDEP PRINTER
11 FLIGHT STRIP TRAY
12 ARTS TRACKBALL
13 ARTS QUICK LOOK PANEL
14 ARTS KEYBOARD
15 FLIGHT STRIP HOLDERS
16 ELECTRO WRITER
17 PHONE JACK

POSTED PAPERWORK
A TEAM SUPERVISOR'S CHECKLIST
B ATLANTA WEATHER REPORT
C TELEPHONE DIAL CODES
D POSITION SIGN-IN LOG/APPROACH CONTROLLERS
E ATLANTA WEATHER REPORTS

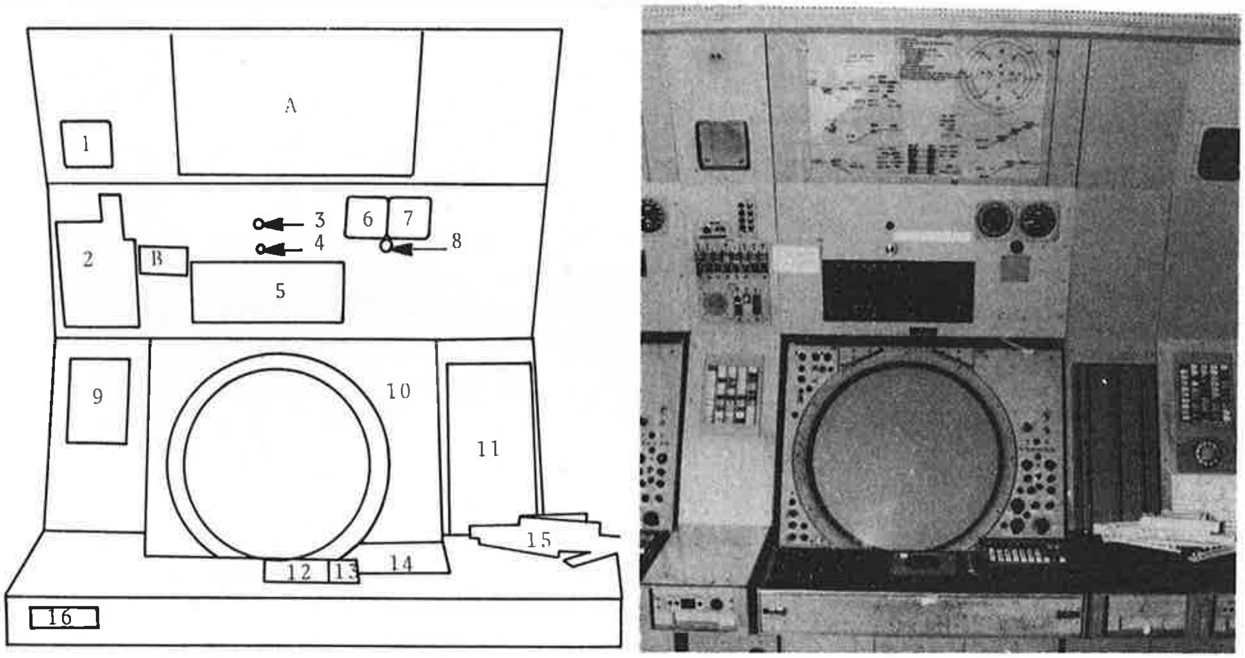
FIGURE 2-13. AH-3 (ARRIVAL HANDOFF) POSITION LAYOUT



DEVICES
1 TELCO SPEAKER
2 FAA COMMUNICATION PANELS
3 VIDEO MAP SELECTOR
4 RHEOSTAT FOR ITEM A BACKLIGHT
5 RHEOSTAT FOR HALO LIGHT
6 RVR PANEL
7 WIND DIR. INDICATOR
8 WIND SPEED INDICATOR
9 RHEOSTAT FOR WIND INSTR.
10 DIGITAL ALTIMETER
11 TELCO KEY PACK
12 ARTS PLAN VIEW DISPLAY/CONTROLS
13 ELECTRO WRITER (FOR AH-3)
14 ARTS TRACKBALL
15 ARTS QUICK LOOK PANEL
16 ARTS KEYBOARD
17 PHONE JACK

POSTED PAPER WORK
A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B ATLANTA WEATHER REPORTS (FOR AH-3)

FIGURE 2-14. AR-1 (ARRIVAL RADAR) POSITION LAYOUT



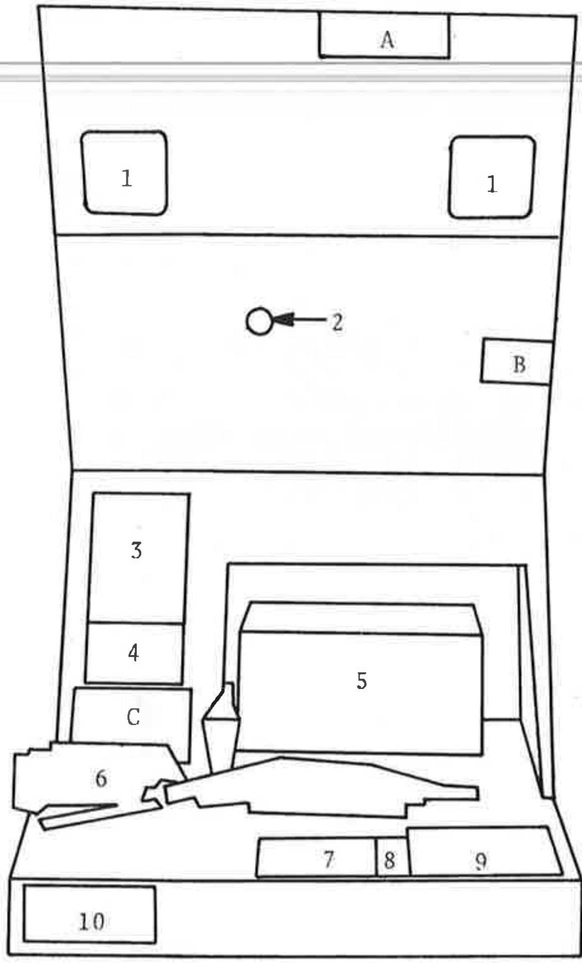
DEVICES

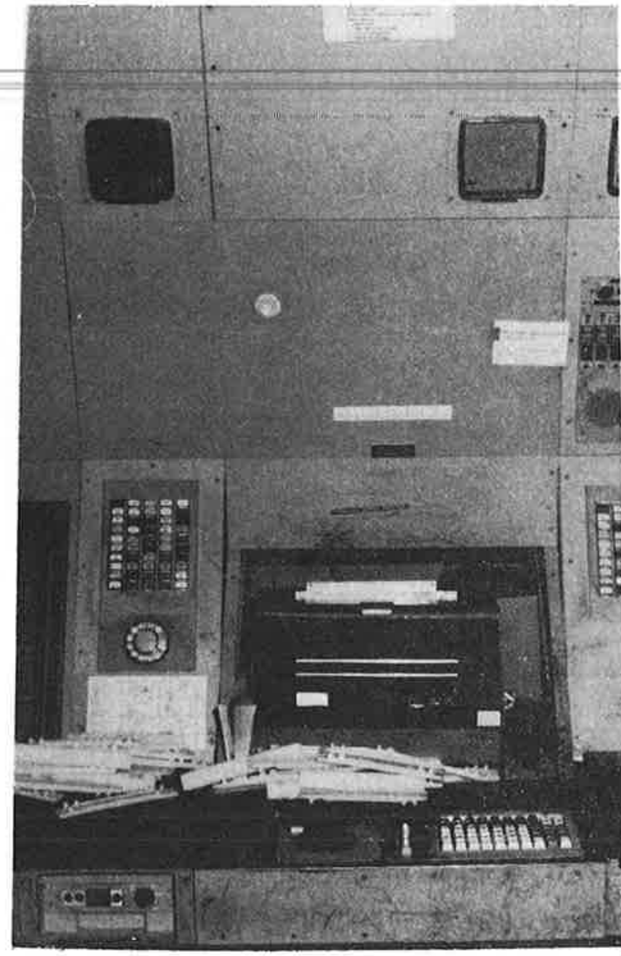
1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 RHEOSTAT FOR ITEM A BACKLIGHT
4 RHEOSTAT FOR HALO LIGHT
5 RVR PANEL
6 WIND DIR. INDICATOR
7 WIND SPEED INDICATOR
8 RHEOSTAT FOR WIND INSTR.
9 TELCO KEYPACK
10 ARTS PLAN VIEW DISPLAY/CONTROLS
11 FLIGHT STRIP TRAY
12 ARTS TRACKBALL
13 ARTS QUICK LOOK PANEL
14 ARTS KEYBOARD
15 FLIGHT STRIP HOLDERS
16 PHONE JACK

POSTED PAPER WORK

A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B COMMUNICATION INSTRUCTIONS

FIGURE 2-15. AR-2 (ARRIVAL RADAR) POSITION LAYOUT

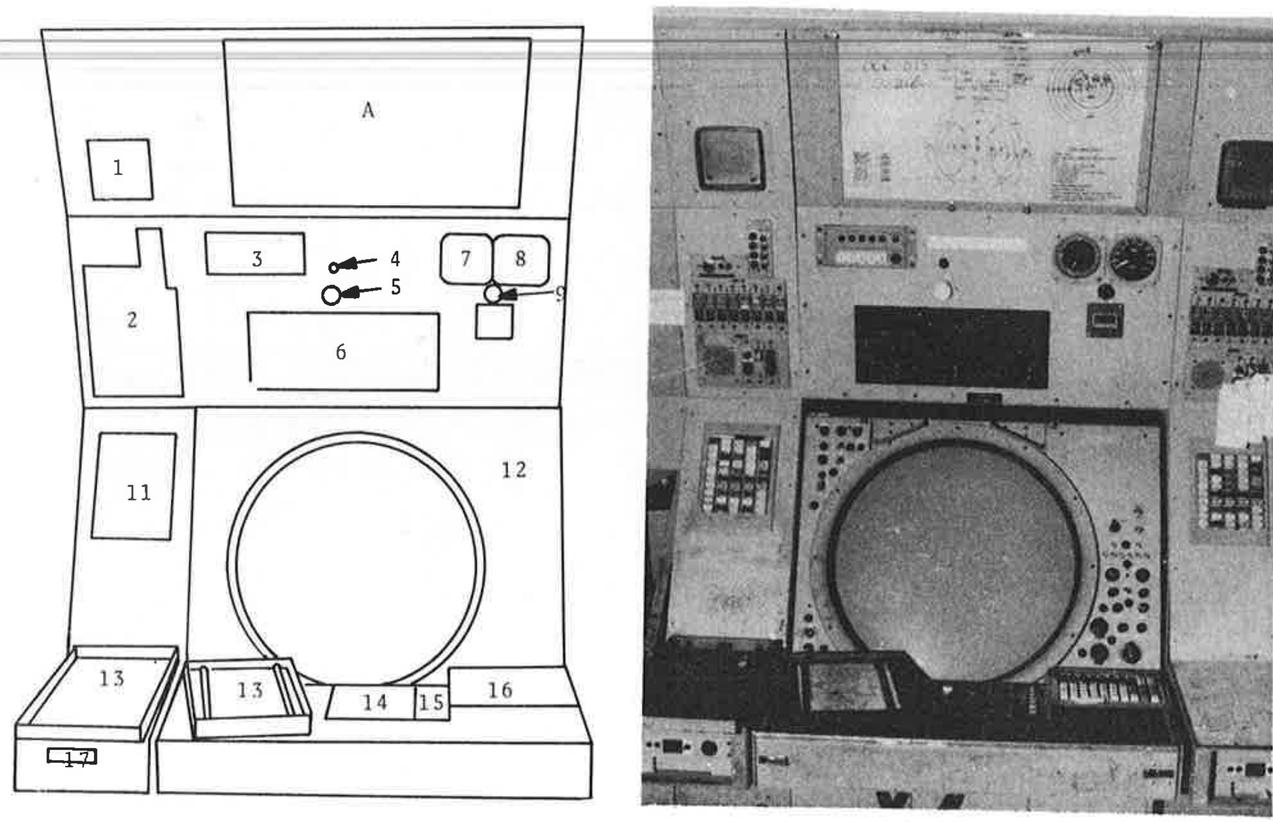




DEVICES
1 TELCO SPEAKER
2 HALO LIGHT CONTROL
3 TELCO KEY PACK
4 TELCO DIAL BOX
5 FDEP PRINTER
6 FLIGHT STRIP HOLDERS
7 ARTS TRACKBALL
8 ARTS QUICK LOOK PANEL
9 ARTS KEYBOARD
10 PHONE JACK

POSTED PAPERWORK
A TEAM SUPERVISOR'S CHECKLIST
B COMMUNICATION INSTRUCTIONS
C TELEPHONE DIAL CODES

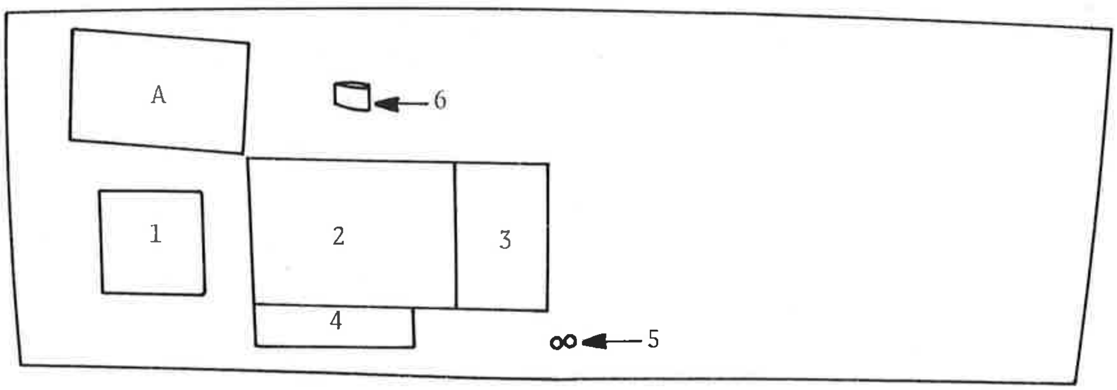
FIGURE 2-16. AH-2 (ARRIVAL HANDOFF) POSITION LAYOUT



DEVICES
1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 VIDEO MAP SELECTOR
4 RHEOSTAT FOR ITEM A BACKLIGHT
5 RHEOSTAT FOR HALO LIGHT
6 RVR PANEL
7 WIND DIR. INDICATOR
8 WIND SPEED INDICATOR
9 RHEOSTAT FOR WIND INSTR.
10 DIGITAL ALTIMETER
11 TELCO KEY PACK
12 ARTS PLAN VIEW DISPLAY/CNTRLS
13 PORTABLE FLT. STRIP TRAY
14 ARTS TRACKBALL
15 ARTS QUICK LOOK PANEL
16 ARTS KEYBOARD
17 PHONE JACK

POSTED PAPERWORK
A PERTINENT AIR TRAFFIC CONTROL INFORMATION

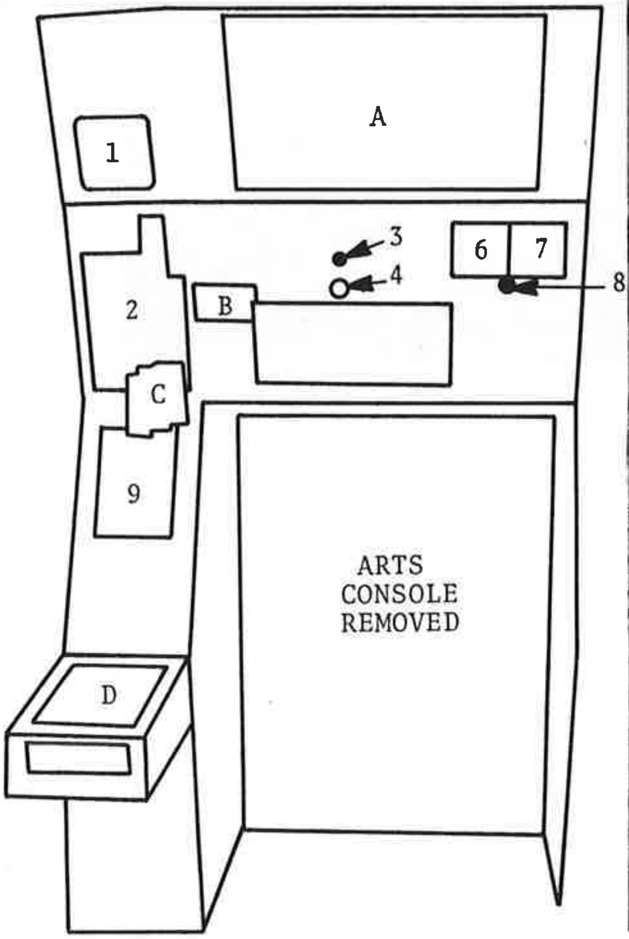
FIGURE 2-17. TAR-2 (TERMINAL ARRIVAL RADAR) POSITION LAYOUT

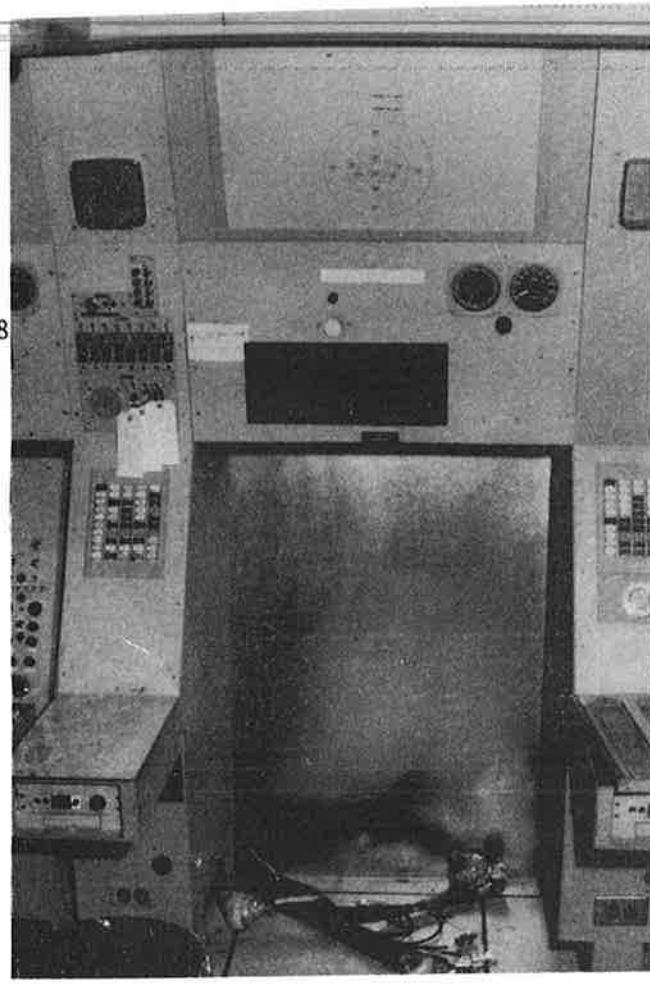


DEVICES
1 TELCO SPEAKER
2 TELCO KEYPACK
3 TELCO DIAL BOX
4 PHONE JACK
5 MAINTENANCE PHONE JACK
6 INCOMING CALL LIGHT

POSTED PAPER WORK
A TELEPHONE DIAL CODES

FIGURE 2-18. CI - NORTH ARRIVAL POSITION LAYOUT





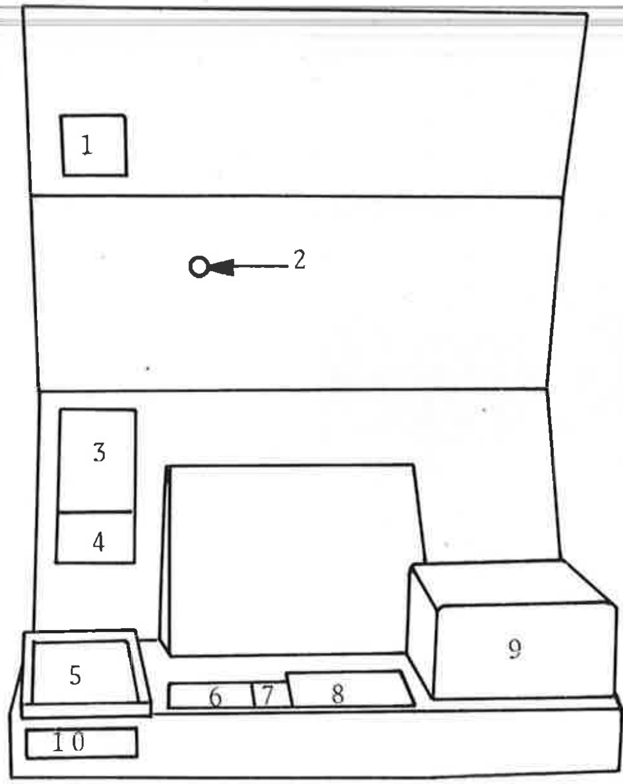
DEVICES

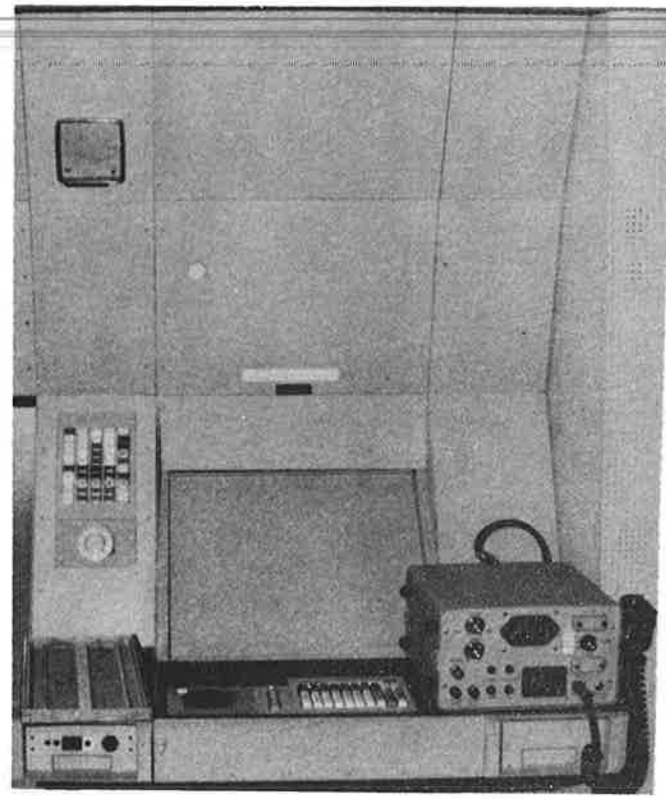
1. TELCO SPEAKER
2. FAA' COMMUNICATION PANELS
3. RHEOSTAT FOR ITEM A BACKLIGHT
4. RHEOSTAT FOR HALO LIGHT
5. RVR PANEL
6. WIND DIR. INDICATOR
7. WIND SPEED INDICATOR
8. RHEOSTAT FOR WIND INSTR.
9. TELCO KEY PACK
10. PHONE TALK

POSTED PAPERWORK

A. PERTINENET AIR TRAFFIC CONTROL INFORMATION
B. COMMUNICATION INSTRUCTIONS
C. MAINTENANCE STATUS NOTES
D. ARRIVAL AIRSPACE ALLOCATION CHARTS

FIGURE 2-19. TAR-4 (TERMINAL ARRIVAL RADAR) POSITION LAYOUT





DEVICES
1 TELCO SPEAKER
2 HALO LIGHT CONTROL
3 TELCO KEY PACK
4 TELCO DIAL BOX
5 PORTABLE FLIGHT STRIP TRAY
6 ARTS TRACKBALL
7 ARTS QUICK LOOK PANEL
8 ARTS KEYBOARD
9 TRANSCEIVER FOR BACKUP FAA
10 PHONE JACK

FIGURE 2-20. AH-4 (ARRIVAL HANDOFF) POSITION LAYOUT

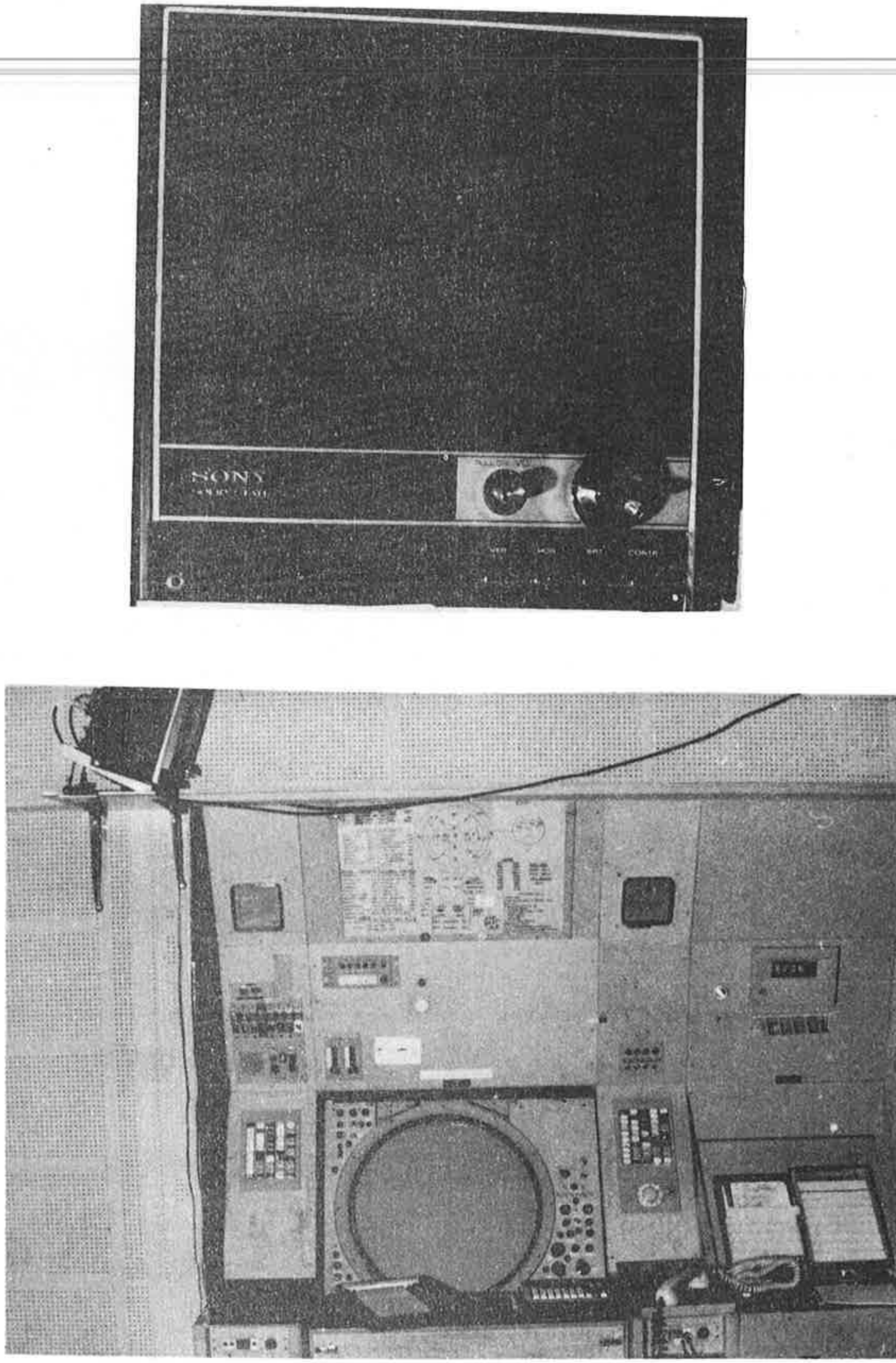
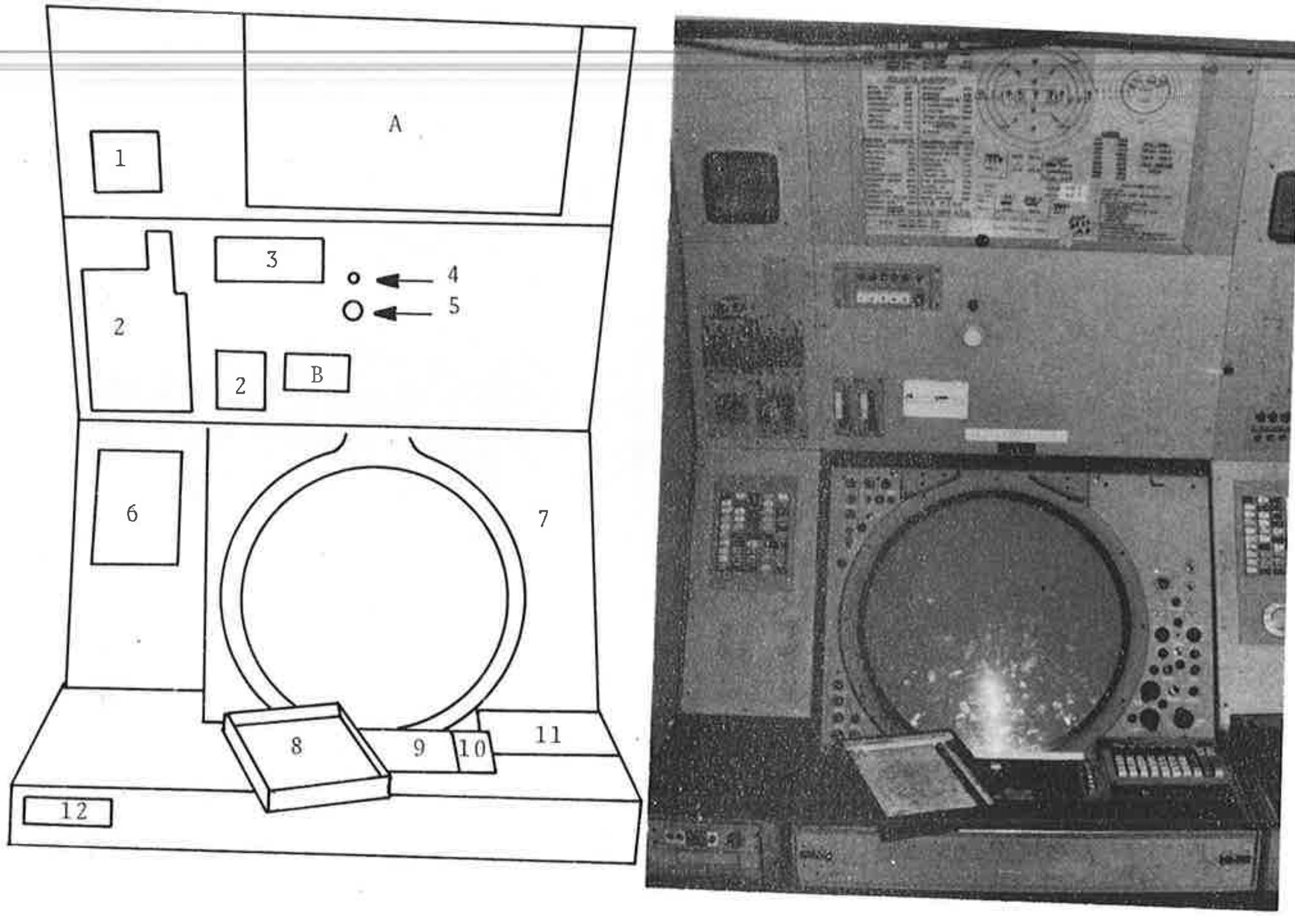


FIGURE 2-21. CLOSED CIRCUIT T.V. MONITOR - WEATHER REPORTS FOR SATELLITE CONTROLLERS



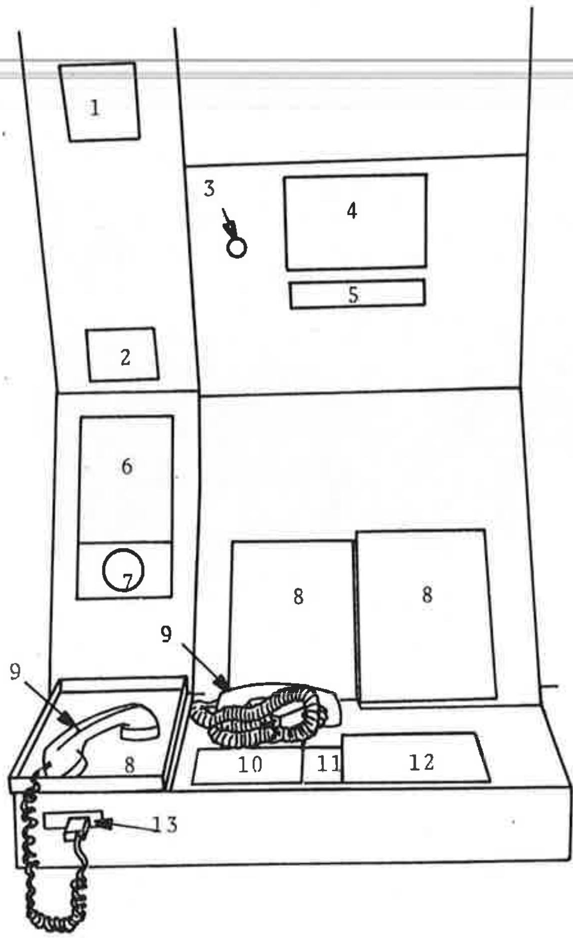
DEVICES

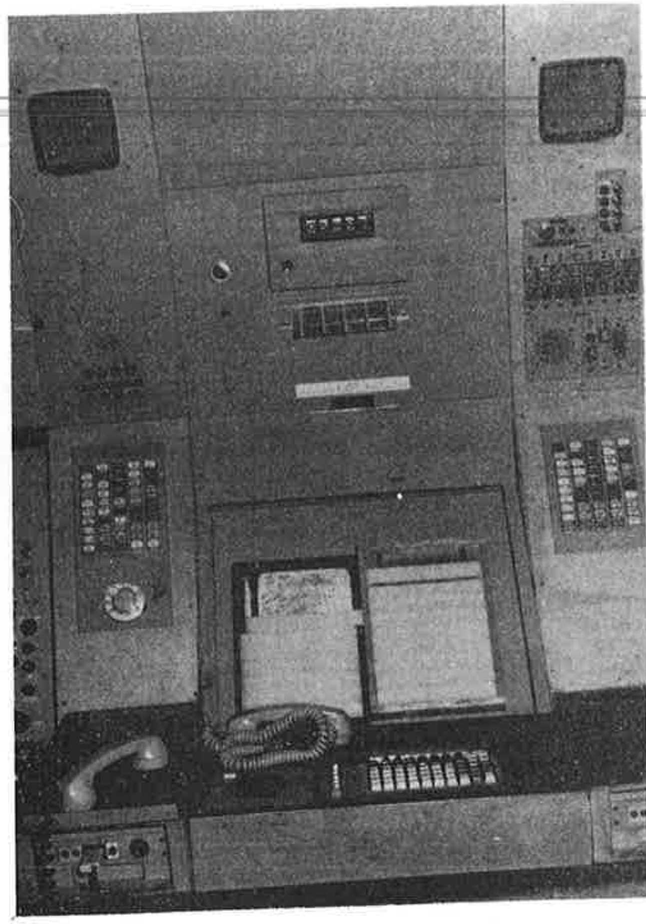
1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 VIDEO MAP SELECTOR
4 RHEOSTAT FOR ITEM A BACKLIGHT
5 RHEOSTAT FOR HALO LIGHT
6 TELCO KEY PACK
7 ARTS PLAN VIEW DISPLAY/CONTROLS
8 PORTABLE FLIGHT STRIP TRAY
9 ARTS TRACKBALL
10 ARTS QUICK LOOK PANEL
11 ARTS KEYBOARD
12 PHONE JACK

POSTED PAPER WORK

A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B COMMUNICATION INSTRUCTIONS

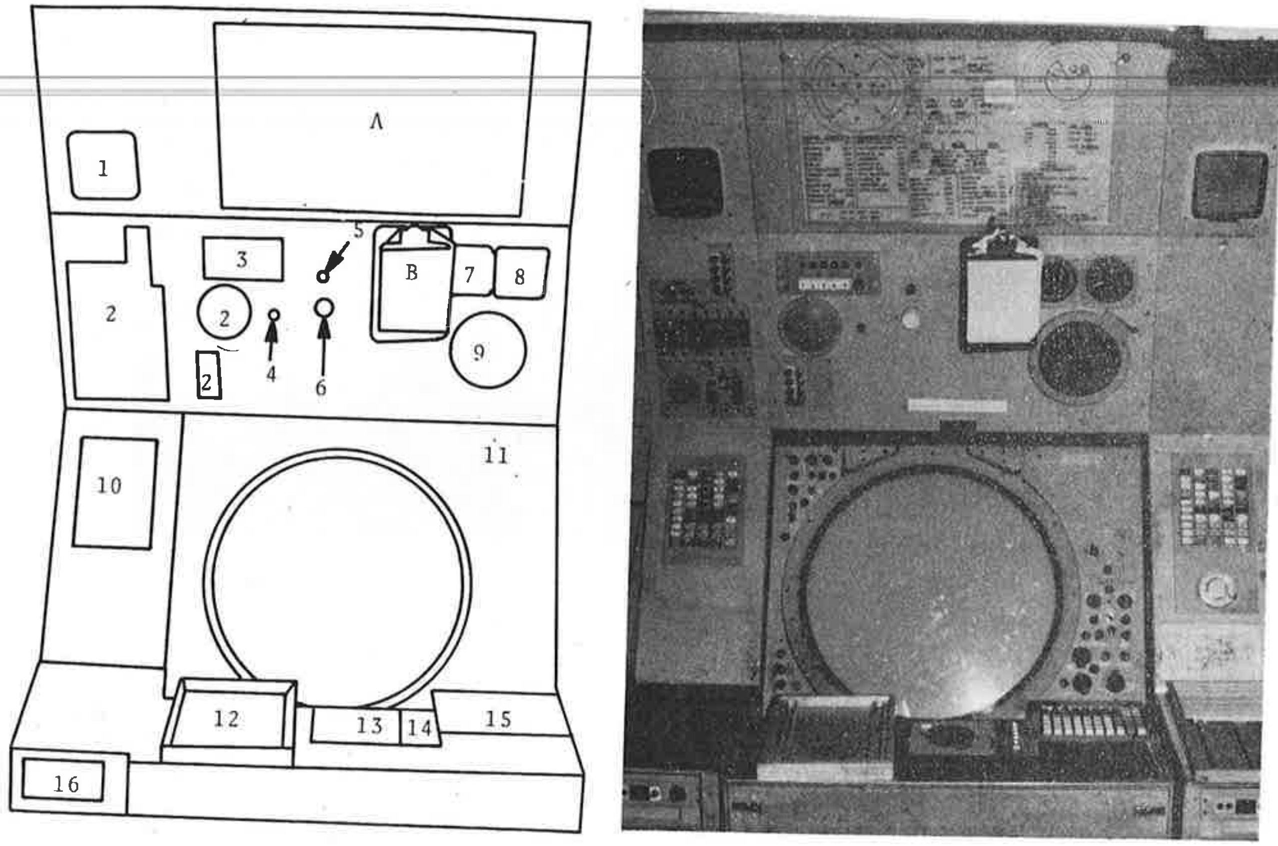
FIGURE 2-22. SAT-3 (SATELLITE RADAR) POSITION LAYOUT





DEVICES
1 TELCO SPEAKER
2 UHF FREQ UTILIZATION PANEL
3 RHEOSTAT FOR HALO LIGHT
4 DIGITAL CLOCK
5 FORMER FEED SLOT FOR AN ELECTRO WRITER
6 TELCO KEYPACK
7 TELCO DIAL BOX
8 PORTABLE FLIGHT STRIP TRAY
9 HAND PHONE
10 ARTS TRACKBALL
11 ARTS QUICK LOOK PANEL
12 ARTS KEYBOARD
13 PHONE JACK

FIGURE 2-23. SATH-3 (SATELLITE HANDOFF) POSITION LAYOUT



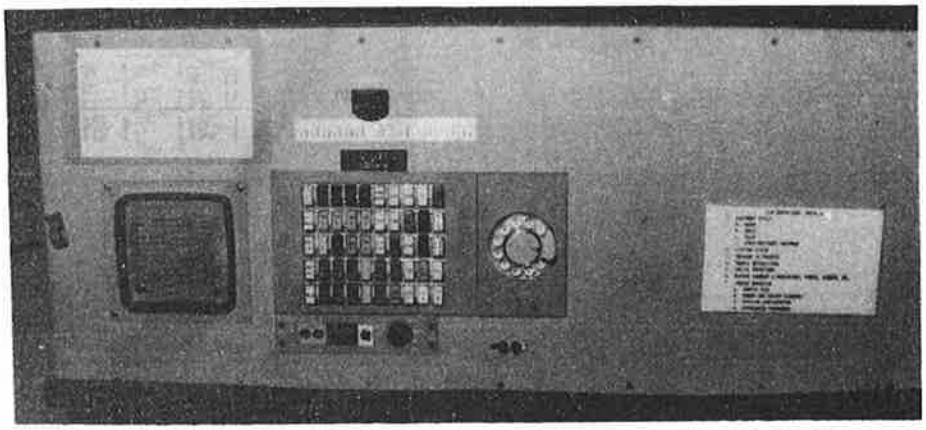
DEVICES

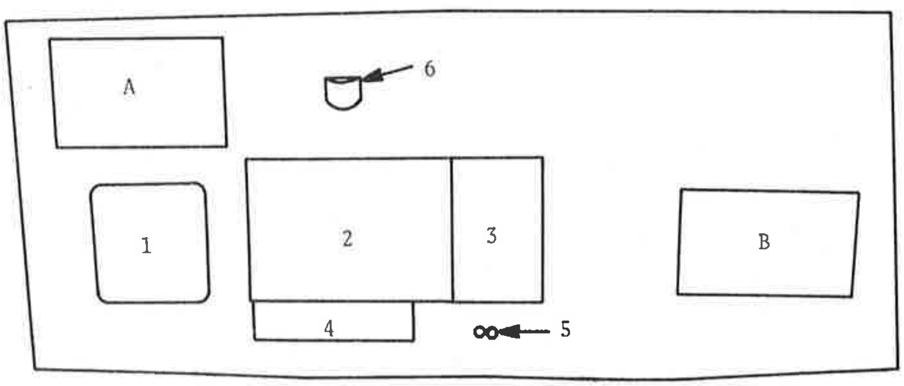
1 TELCO SPEAKER
2 FAA COMMUNICATIONS PANELS
3 VIDEO MAP SELECTOR
4
5 RHEOSTAT FOR ITEM A BACKLIGHT
6 RHEOSTAT FOR HALO LIGHT
7 WIND DIR. INDICATOR
8 WIND SPEED INDICATOR
9 ANALOG ALTIMETER
10 TELCO KEY PACK
11 ARTS PLAN VIEW DISPLAY/ CONTROLS
12 PORTABLE FLIGHT STRIP TRAY
13 ARTS TRACKBALL
14 ARTS QUICK LOOK PANEL
15 ARTS KEYBOARD
16 PHONE JACK

POSTED PAPERWORK

A PERTINENT AIR TRAFFIC CONTROL INFORMATION
B DOBBINS AFB WEATHER

FIGURE 2-24. SAT-2 (SATELLITE RADAR) POSITION LAYOUT

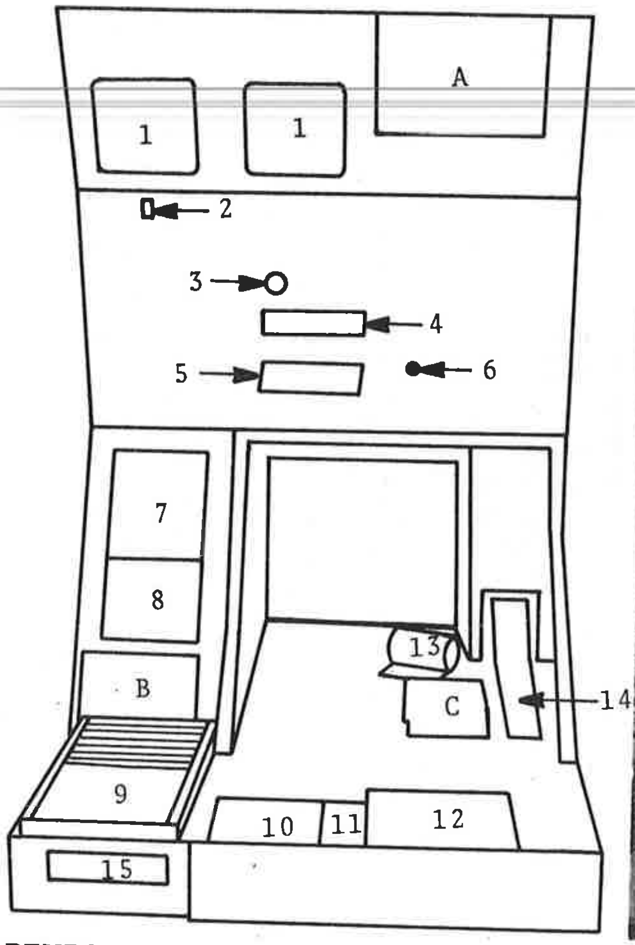


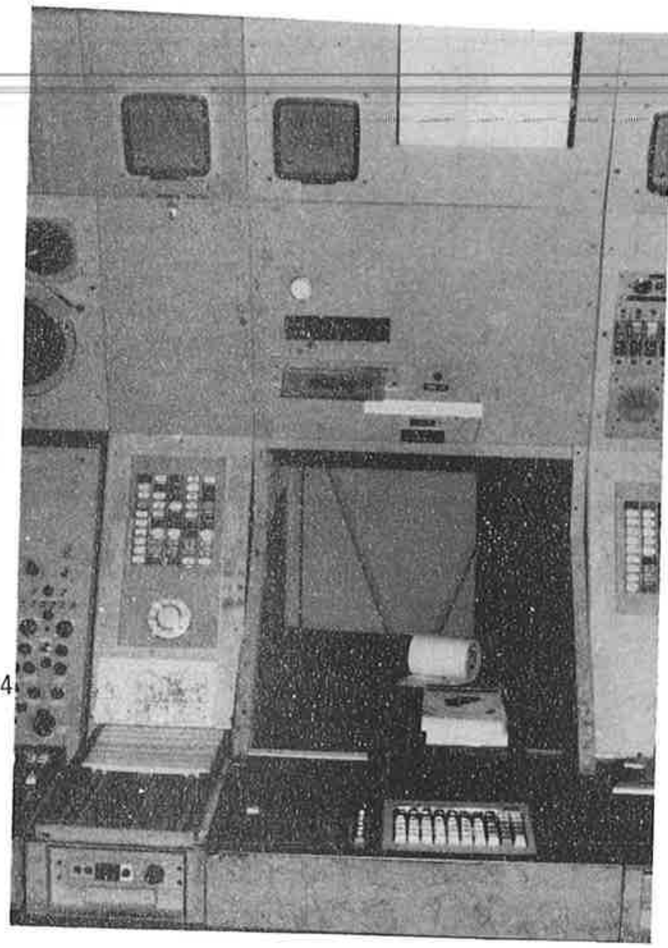


DEVICES
1 TELCO SPEAKER
2 TELCO KEYPACK
3 TELCO DIAL BOX
4 PHONE JACK
5 MAINTENANCE PHONE JACK
6 INCOMING CALL LIGHT

POSTED PAPERWORK
A TELEPHONE DIAL CODES
B TEAM SUPERVISOR'S CHECKLIST

FIGURE 2-25. CI-SAT (SATELLITE) POSITION LAYOUT





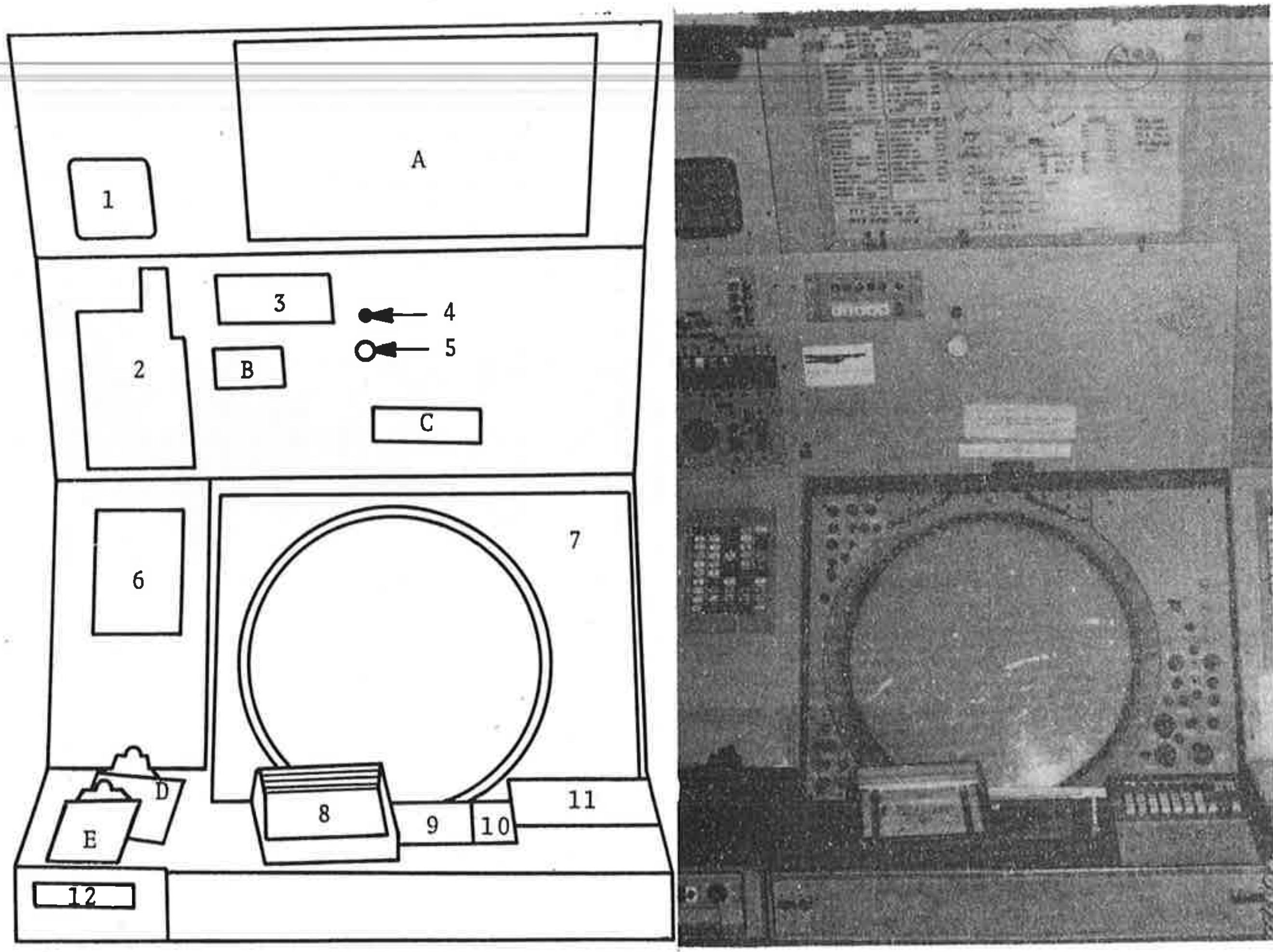
DEVICES

1. TELCO SPEAKER
2. HOOK/SAT APP. PLATES
3. RHEOSTAT FOR HALO LIGHT
4. DEVICE REMOVED
5. FORMER FEED SLOT FOR AN ELECTRO WRITER
6.
7. TELCO KEYPACK
8. TELCO DIAL BOX
9. PORTABLE FLIGHT STRIP TRAY
10. ARTS TRACKBALL
11. ARTS QUICK LOOK PANEL
12. ARTS KEYBOARD
13. PAPER ROLE FOR ELECTRO WRITER
14. FLT. STRIP DROP TUBE/EXIT
15. PHONE JACK

POSTED PAPER WORK

A. PLAN VIEW DISPLAY INSTRUCTIONS
B. TELEPHONE DIAL CODES
C. PUBLICATION "INSTRUMENT APPROACH PROC./U.S. SOUTHEAST"

FIGURE 2-26. SATH-2 (SATELLITE HANDOFF) POSITION LAYOUT



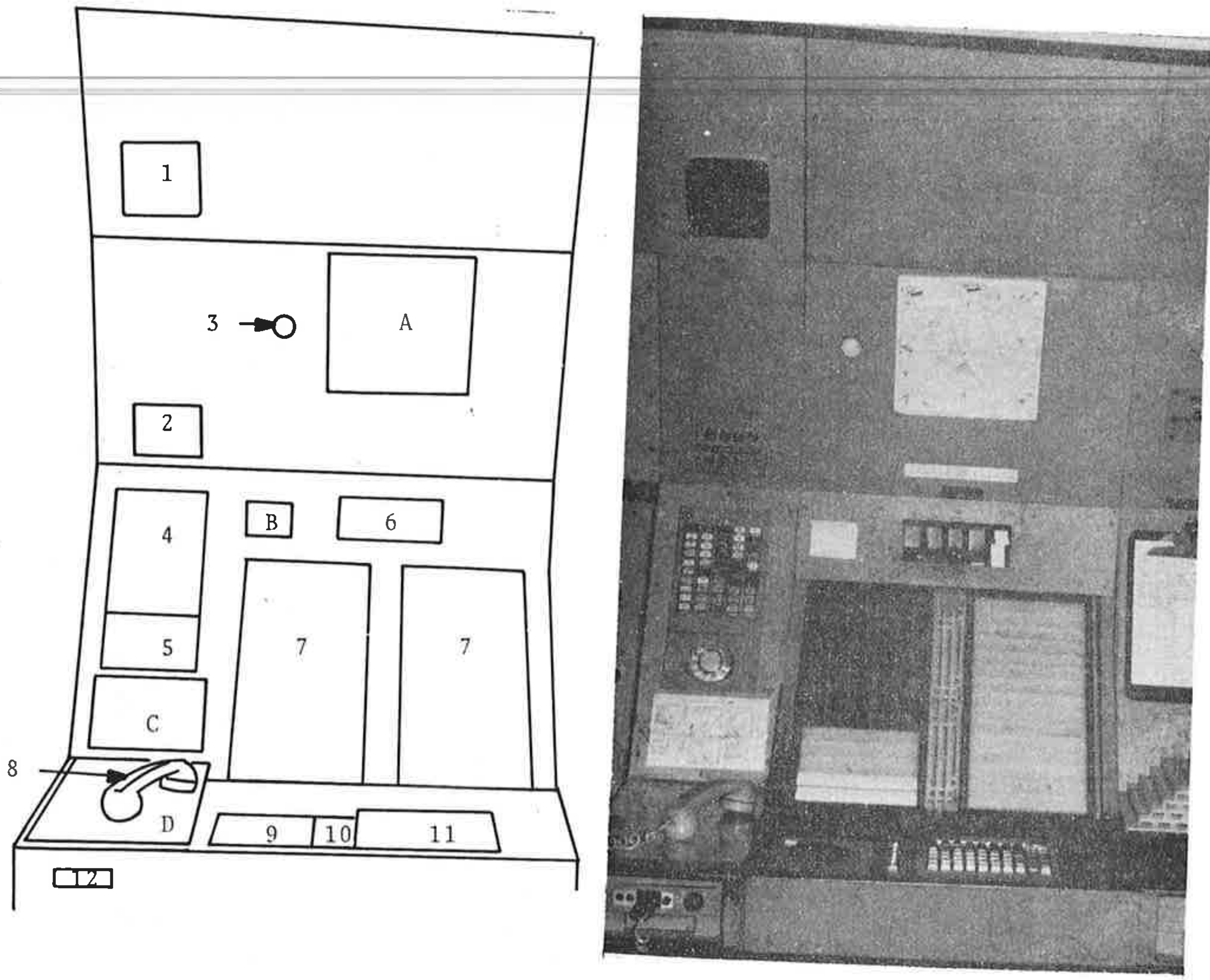
DEVICES

1. TELCO SPEAKER
2. FAA COMMUNICATIONS PANELS
3. VIDEO MAP SELECTOR
4. RHEOSTAT FOR ITEM A BACKLIGHT
5. RHEOSTAT FOR HALO LIGHT
6. TELCO KEYPACK
7. ARTS PLAN VIEW DISPLAY/ CONTROLS
8. PORTABLE FLT. STRIP TRAY
9. ARTS TRACKBALL
10. ARTS QUICK LOOK PANEL
11. ARTS KEYBOARD
12. PHONE JACK

POSTED PAPER WORK

A. PERTINENT AIR TRAFFIC CONTROL INFORMATION
B. COMMUNICATION INSTRUCTIONS
C. LIGHTING INSTRUCTIONS FOR BERRY HILL AIRPORT
D. PEACH TREE AIRPORT WEATHER/CLIP BOARD
E. FULTON AIRPORT WEATHER/CLIP BOARD

FIGURE 2-27. SAT-1 (SATELLITE RADAR) POSITION LAYOUT



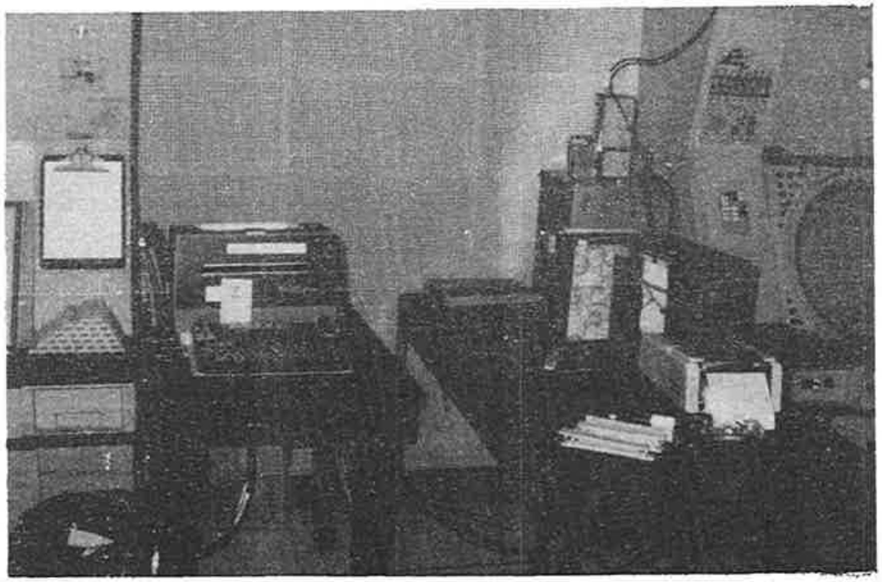
DEVICES

1 TELCO SPEAKER
2 UHF FREQ. UTILIZATION PANEL
3 RHEOSTAT FOR HALO LIGHT
4 TELCO KEYPACK
5 TELCO DIAL BOX
6 FLT. STRIP STORAGE BIN
7 FLIGHT STRIP TRAYS
8 HAND PHONE
9 ARTS TRACKBALL
10 ARTS QUICK LOOK PANEL
11 ARTS KEYBOARD
12 PHONE JACK

POSTED PAPERWORK

A ATL APPRAOCH CHART
B THUNDERSTORM INTENSITY LEVELS
C TELEPHONE DIAL CODES
D SATELLITE AIRSPACE ALLOCATION CHARTS

FIGURE 2-28. SATH-1 (SATELLITE HANDOFF) POSITION LAYOUT



DEVICES
1 RHEOSTAT FOR HALO LIGHT
2 FDEP CONTROL SWITCH
3 FLIGHT STRIP HOLDERS
4 FDEP PRINTER
5 FDEP KEYBOARD
6 CLOSED CIRCUIT T.V. CAMERA BOX-WEATHER REPORTS TO SATELLITE CONTROLLERS
7 TELAUTOGRAPH
8 ELECTROWRITER

PAPERWORK
A SATELLITE CONTROLLER SIGN-IN LOG
B REFERENCE MANUALS

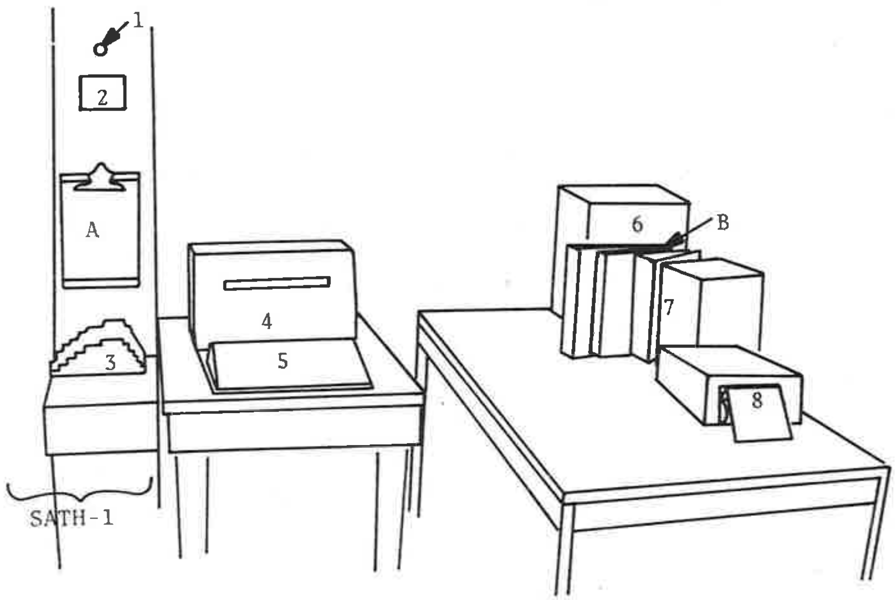
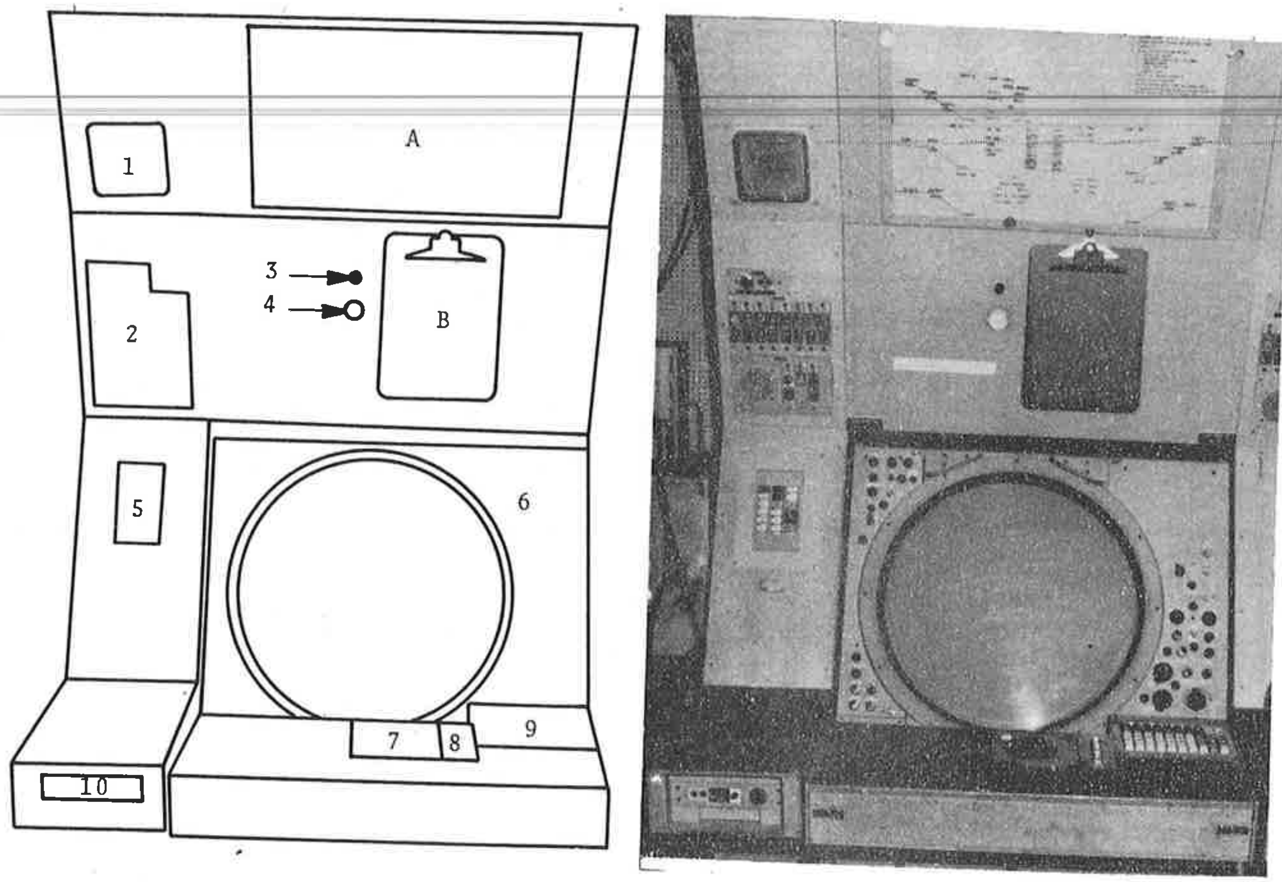


FIGURE 2-29. MISCELLANEOUS EQUIPMENT AREA (BETWEEN SATH-1 AND FINAL MONITOR POSITIONS)



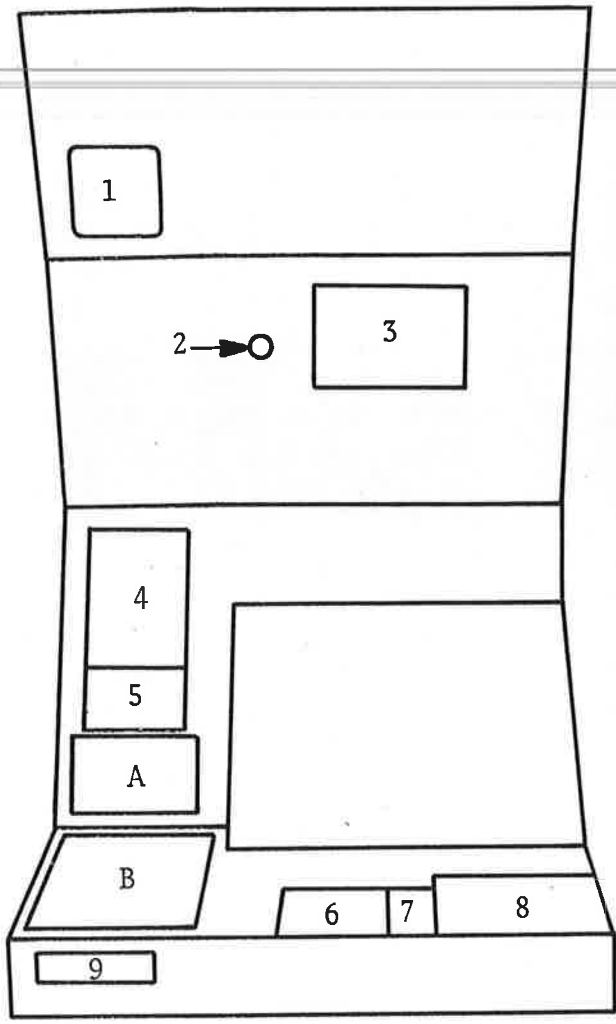
DEVICES

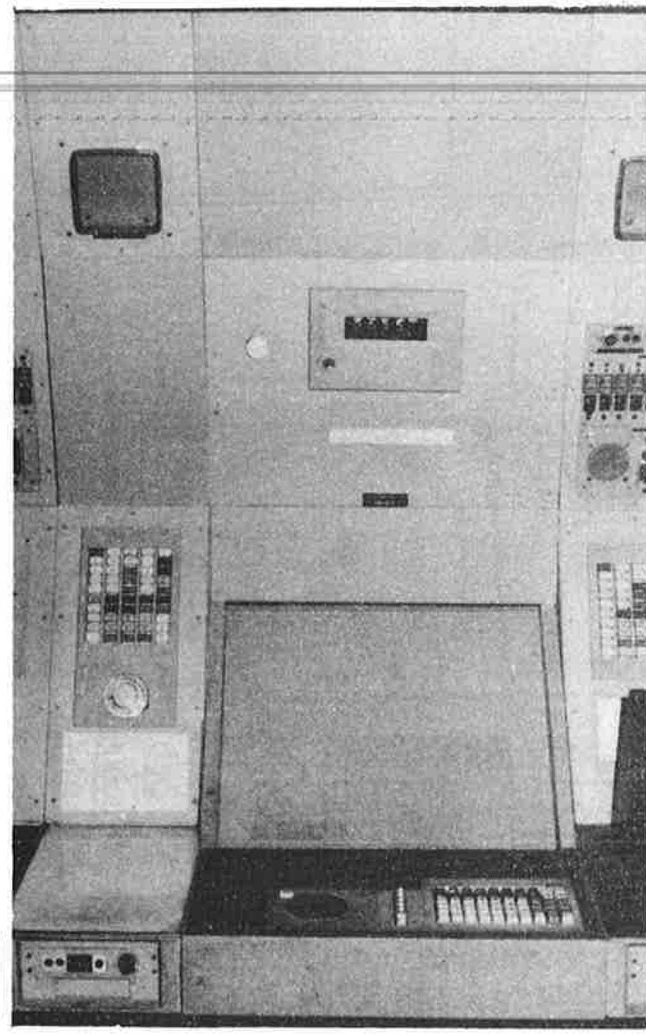
1. TELCO SPEAKER
2. FAA COMMUNICATIONS PANELS
3. RHEOSTAT FOR ITEM A BACKLIGHT
4. RHEOSTAT FOR HALO LIGHT
5. TELCO KEY PACK
6. ARTS PLAN VIEW DISPLAY/CONTROLS
7. ARTS TRACKBALL
8. ARTS QUICK LOOK PANEL
9. ARTS KEYBOARD
10. PHONE JACK

POSTED PAPER WORK

A. PERTINENT AIR TRAFFIC CONTROL INFORMATION
B. POSITION SIGN IN LOG/CLIP BOARD

FIGURE 2-30. FINAL MONITOR 1/2 POSITION LAYOUT





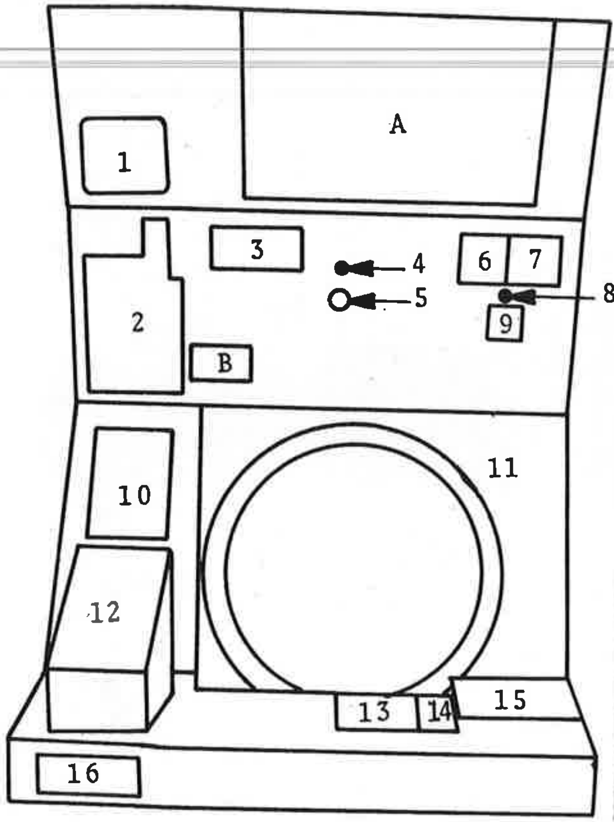
DEVICES

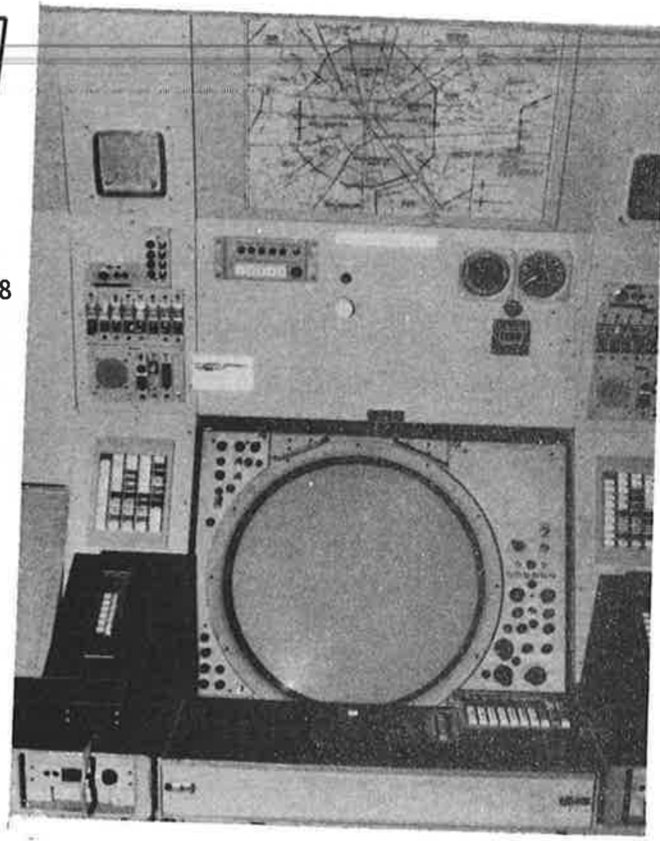
1. TELCO SPEAKER
2. HALO LIGHT CONTROL
3. DIGITAL CLOCK
4. TELCO KEY PACK
5. TELCO DIAL BOX
6. ARTS TRACKBALL
7. ARTS QUICK LOOK PANEL
8. ARTS KEYBOARD
9. PHONE JACK

POSTED PAPER WORK

A. TELEPHONE DIAL CODES
B. ARTS III SUPERVISORY QUICK REFERENCE CAR

FIGURE 2-31. DH-4 (DEPARTURE HANDOFF) STATION LAYOUT





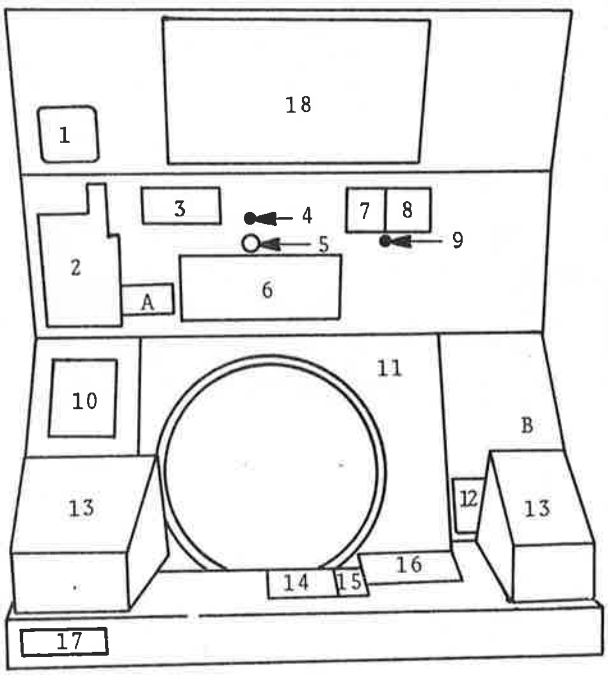
DEVICES

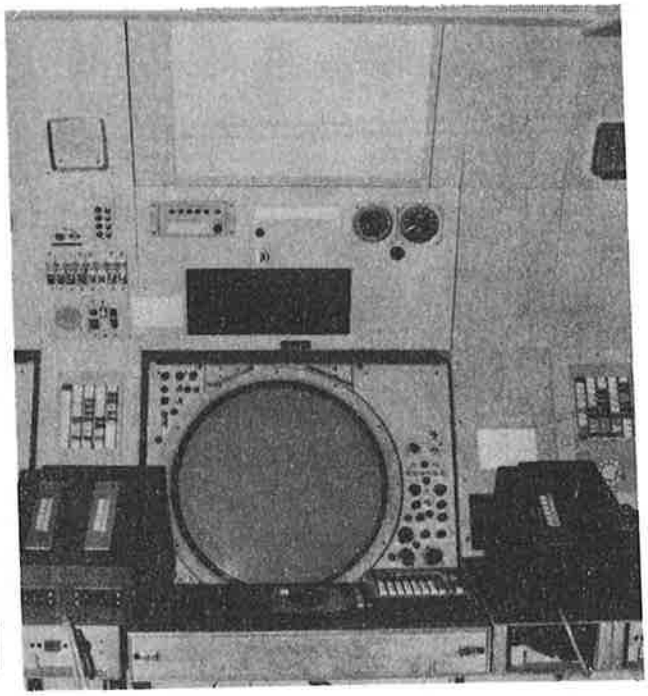
1. TELCO SPEAKER
2. FAA COMMUNICATIONS PANELS
3. VIDEO MAP SELECTOR
4. CONTROL FOR ITEM A BACKLIGHT
5. HALO LIGHT CONTROL
6. WIND DIR. INDICATOR
7. WIND SPEED INDICATOR
8. RHEOSTAT FOR WIND INSTR.
9. DIGITAL ALTIMETER
10. TELCO KEYPACK
11. ARTS PLAN VIEW DISPLAY/ CONTROLS
12. SIMULATION PILOT INPUT PANEL
13. ARTS TRACKBALL
14. ARTS QUICK LOOK PANEL
15. ARTS KEYBOARD
16. PHONE JACK

POSTED PAPER WORK

A. PERTINENT AIR TRAFFIC CONTROL INFORMATION
B. COMMUNICATION INSTRUCTIONS

FIGURE 2-32. DR-4 (DEPARTURE RADAR) POSITION LAYOUT





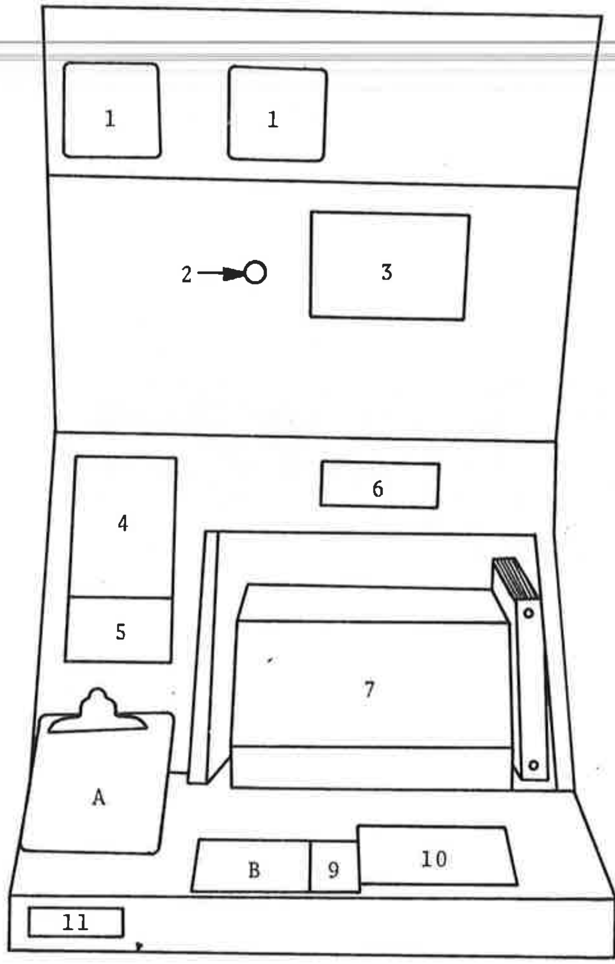
DEVICES

1. TELCO SPEAKER
2. FAA COMMUNICATION PANELS
3. VIDEO MAP SELECTOR
4. RHEOSTAT FOR ITEM 18
5. HALO LIGHT CONTROL
6. RVR PANEL
7. WIND DIR. INDICATOR
8. WIND SPEED INDICATOR
9. LIGHT CONTROL FOR WIND INSTR.
10. TELCO KEYPACK
11. ARTS PLAN VIEW DISPLAY/ CONTROL
12. FORMER FLT. STRIP DROP TUBE EXIT
13. SIMULATION PILOT INPUT PANELS
14. ARTS TRACKBALL
15. ARTS QUICK LOOK PANEL
16. ARTS KEYBOARD
17. PHONE JACK
18. BACK LIGHT PANEL

POSTED PAPER WORK

A. COMMUNICATION INSTRUCTIONS
B. INSTRUCTIONS FOR COMBINING POSITIONS

FIGURE 2-33. DR-2 (DEPARTURE RADAR) POSITION LAYOUT



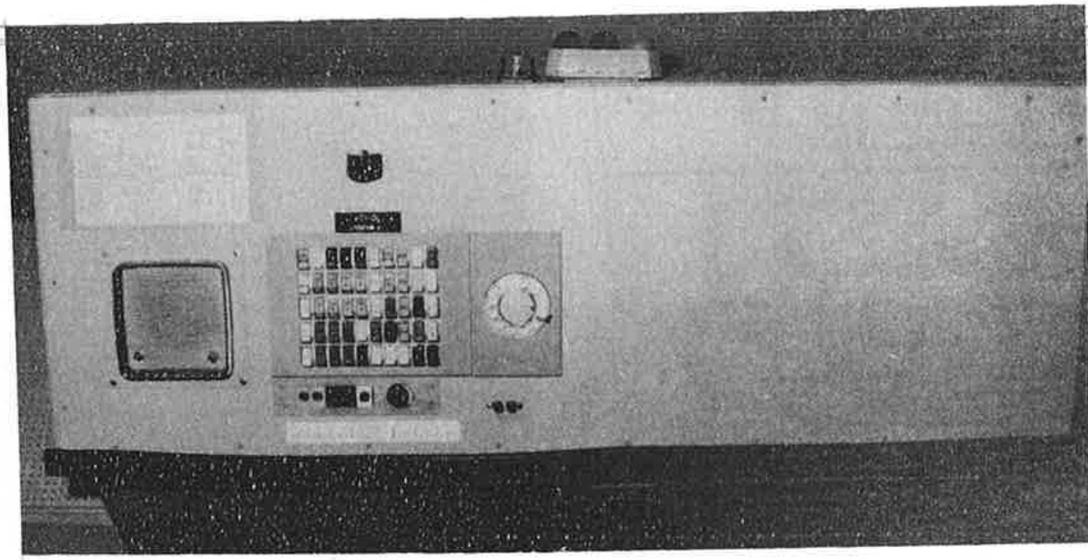
DEVICES

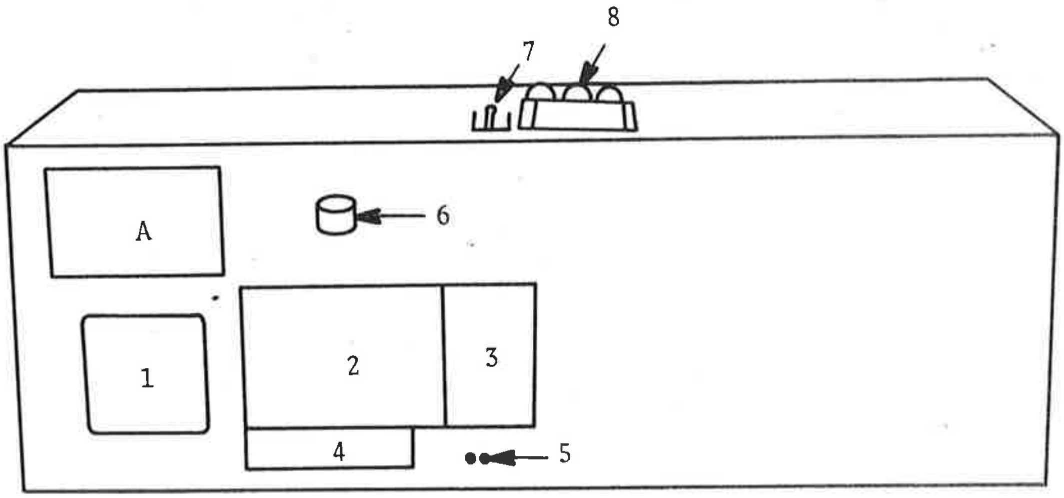
1. TELCO SPEAKER
2. HALO LIGHT CONTROL
3. DIGITAL CLOCK
4. TELCO KEYPACK
5. TELCO DIAL BOX
6. FLT. STRIP STORAGE BIN
7. FDEP PRINTER
8. ARTS TRACKBALL
9. ARTS QUICK LOOK PANEL
10. ARTS KEYBOARD
11. PHONE JACK

POSTED PAPER WORK

A. POSITION SIGN IN CLIPBOARD

FIGURE 2-34. DH-2 (DEPARTURE HANDOFF) POSITION LAYOUT





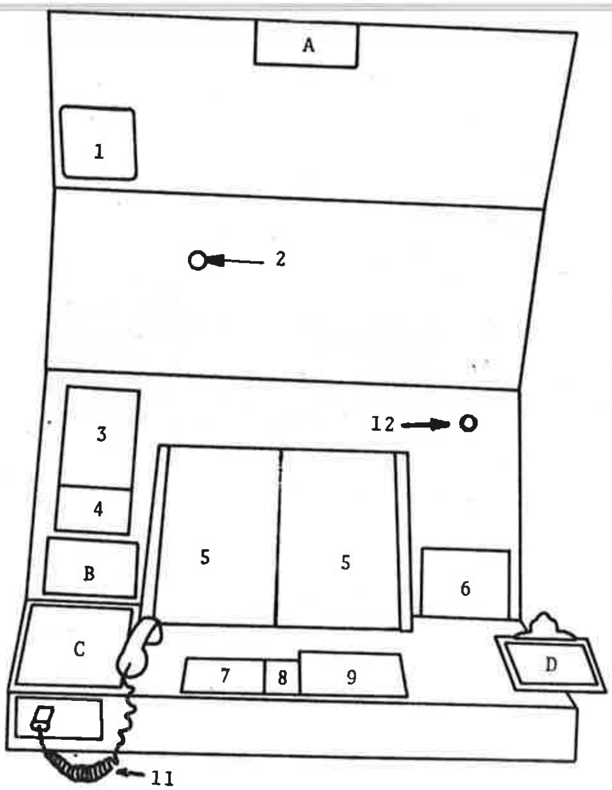
DEVICES

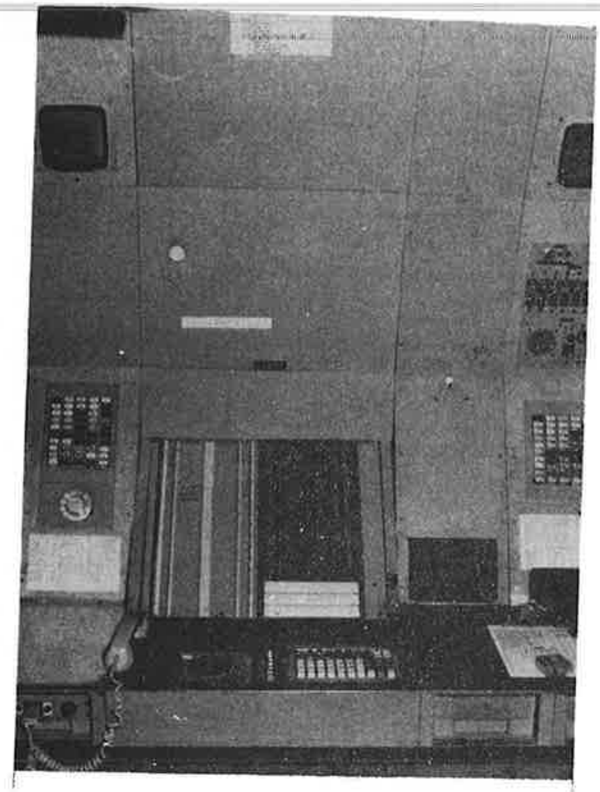
1. TELCO SPEAKER
2. TELCO KEYPACK
3. TELCO DIAL BOX
4. PHONE JACK
5. MAINTENANCE PHONE JACK
6. INCOMING CALL CUE LIGHT
7.
8. CUE LIGHT FOR CENTRAL FLOW CONTROL CALLS

POSTED PAPERWORK

A. TELEPHONE DIAL CODES

FIGURE 2-35. CI-D (DEPARTURES) POSITION LAYOUT





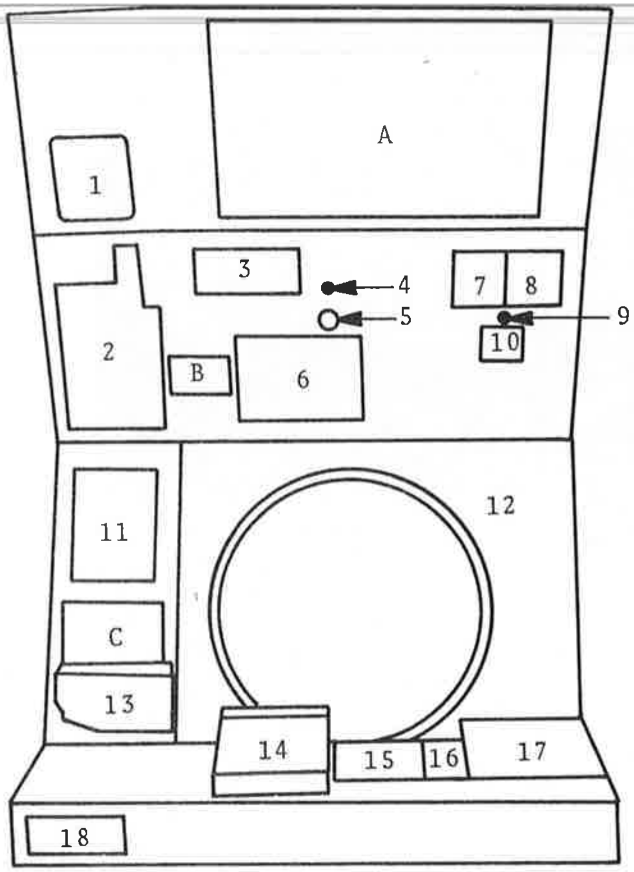
DEVICES

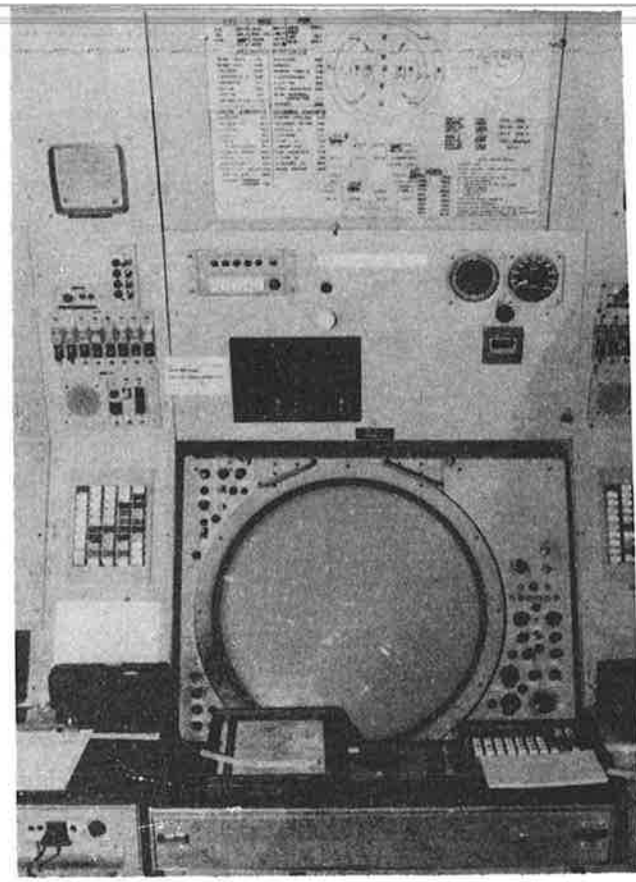
1. TELCO SPEAKER
2. HALO LIGHT CONTROL
3. TELCO KEY PACK
4. TELCO DIAL BOX
5. FLIGHT-STRIP TRAY
6. FLT.-STRIP DROP TUBE EXIT
7. ARTS TRACKBALL
8. ARTS QUICK LOOK PANEL
9. ARTS KEYBOARD
10. PHONE JACK
11. HAND PHONE
12. HOOK FOR SIGN IN LOG

POSTED PAPER WORK

A. TEAM SUPERVISOR'S CHECKLIST
B. TELEPHONE DIAL CODES
C. ARTS III SUPERVISORY QUICK REFERENCE CARD
D. POSITION SIGN-IN LOG/DEPARTURE CONTROLLERS

FIGURE 2-36. DH-3 (DEPARTURE HANDOFF) POSITION LAYOUT





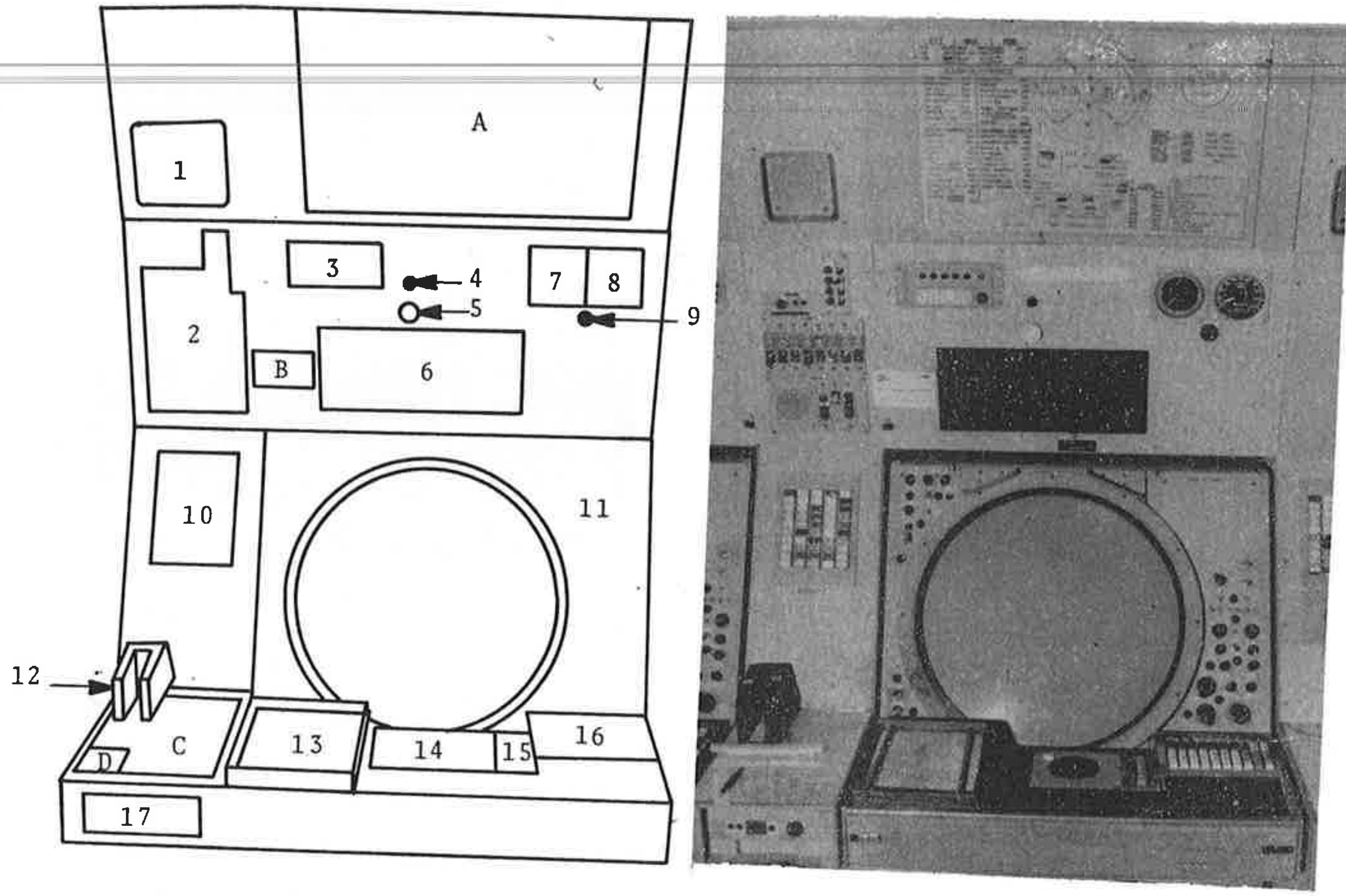
DEVICES

1. TELCO SPEAKER
2. FAA COMMUNICATIONS PANEL
3. VIDEO MAP SELECTOR
4. RHEOSTAT FOR ITEM A BACKLIGHT
5. HALO LIGHT CONTROL
6. RVR PANEL
7. WIND DIR. INDICATOR
8. WIND SPEED INDICATOR
9. RHEOSTAT FOR WIND INSTR.
10. DIGITAL ALTIMETER
11. TELCO KEY PACK
12. ARTS PLAN VIEW DISPLAY/CONTROLS
13. PORTABLE FLT.-STRIP STORAGE BIN
14. PORTABLE FLIGHT-STRIP TRAY
15. ARTS TRACKBALL
16. ARTS QUICK LOOK PANEL
17. ARTS KEYBOARD
18. PHONE JACK

POSTED WORK PAPER

A. PERTINENT AIR TRAFFIC CONTROL INFORMATION
B. COMMUNICATION INSTRUCTION
C. TELEPHONE DIAL CODES

FIGURE 2-37. DR-3 (DEPARTURE RADAR) POSITION LAYOUT



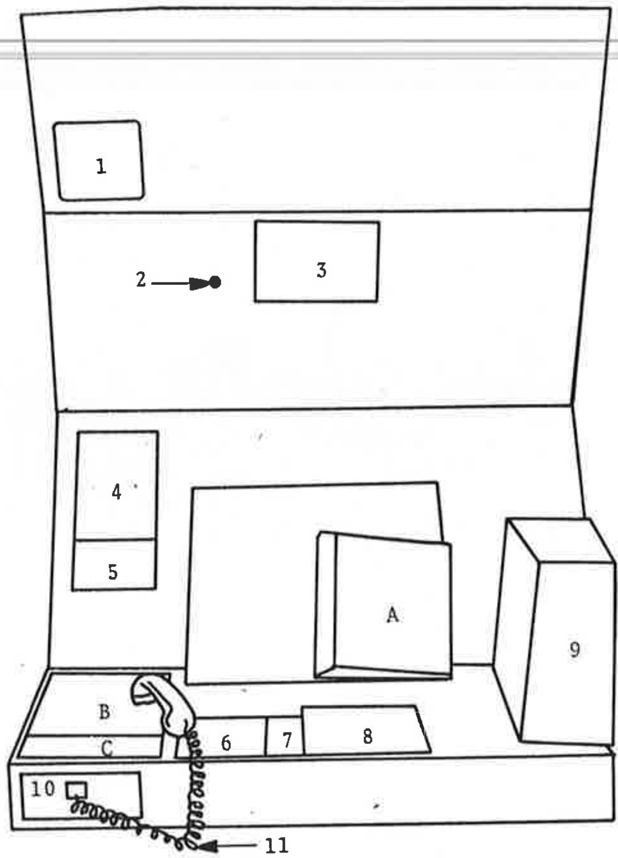
DEVICES

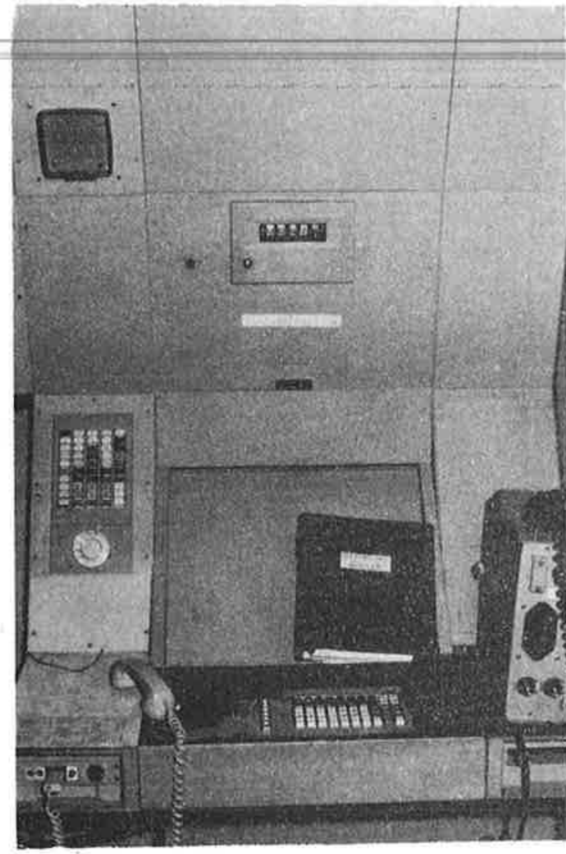
1. TELCO SPEAKER
2. FAA COMMUNICATIONS PANELS
3. VIDEO MAP SELECTOR
4. RHEOSTAT FOR ITEM A BACKLIGHTS
5. HALO LIGHT CONTROL
6. RVR PANEL
7. WIND DIR. INDICATOR
8. WIND SPEED INDICATOR
9. RHEOSTAT FOR WIND INSTR.
10. TELCO KEY PACK
11. ARTS PLAN VIEW DISPLAY/CONTROLS
12. PORTABLE FLT.-STRIP STORAGE BIN
13. PORTABLE FLIGHT-STRIP TRAY
14. ARTS TRACKBALL
15. ARTS QUICK LOOK PANEL
16. ARTS KEYBOARD
17. PHONE JACK

POSTED PAPER WORK

A. PERTINENT AIR TRAFFIC CONTROL INFORMATION
B. COMMUNICATION INSTRUCTIONS
C. DEPARTURE AIRSPACE ALLOCATION CHARTS
D. THUNDERSTORM INTENSITY LEVELS

FIGURE 2-38. DR-1 (DEPARTURE RADAR) POSITION LAYOUT





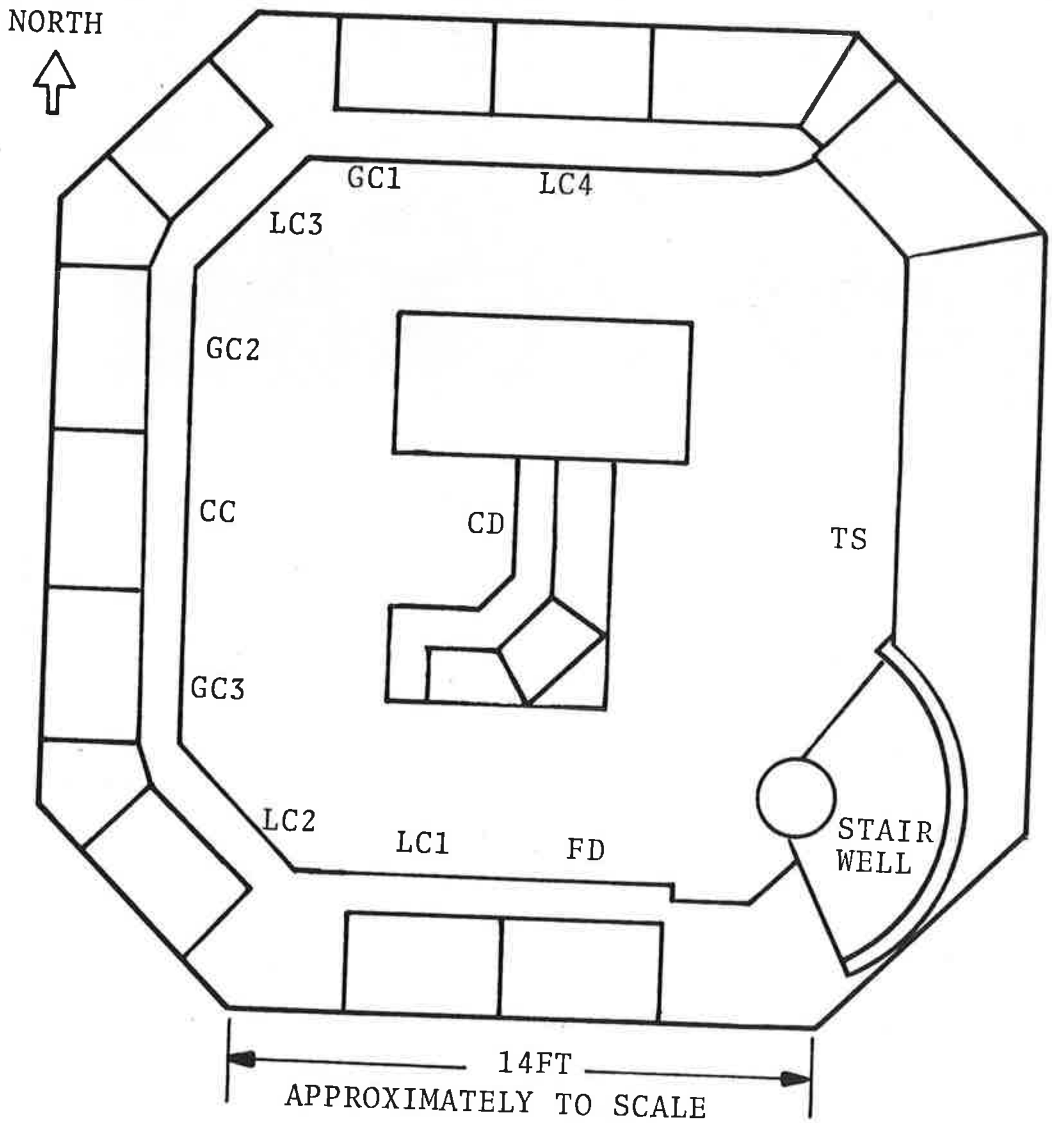
DEVICES

1. TELCO SPEAKER
2. HALO LIGHT CONTROL
3. DIGITAL CLOCK
4. TELCO KEY PACK
5. TELCO DIAL BOX
6. ARTS TRACKBALL
7. ARTS QUICK LOOK PANEL
8. ARTS KEYBOARD
9. TRANSCEIVER FOR BACKUP COMM.
10. PHONE JACK
11. HAND PHONE

POSTED PAPER WORK

A. DEPARTURE BINDER
B. ART III SUPERVISORY QUICK REFERENCE CARD
C. TELEPHONE DIAL CODES

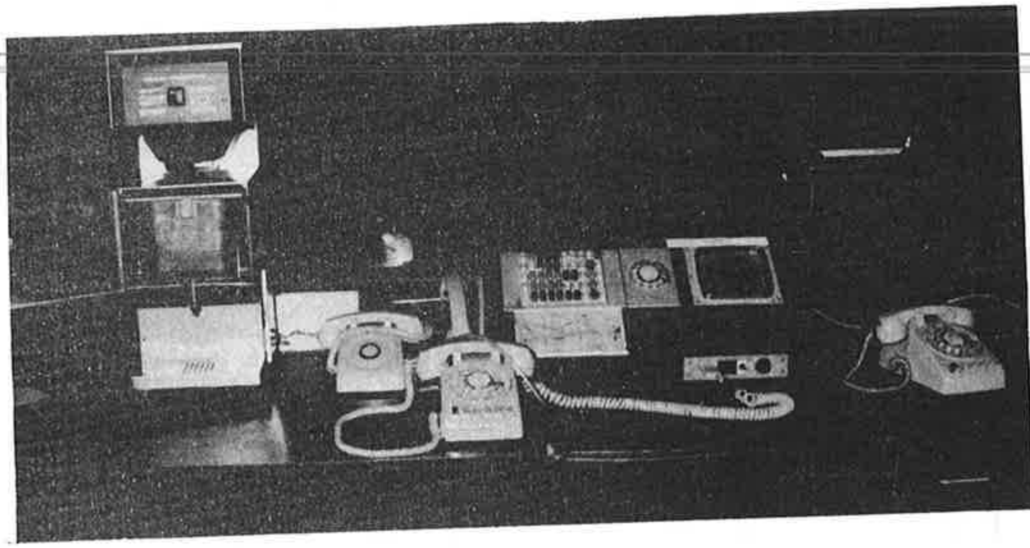
FIGURE 2-39. DH-1 (DEPARTURE HANDOFF) POSITION LAYOUT

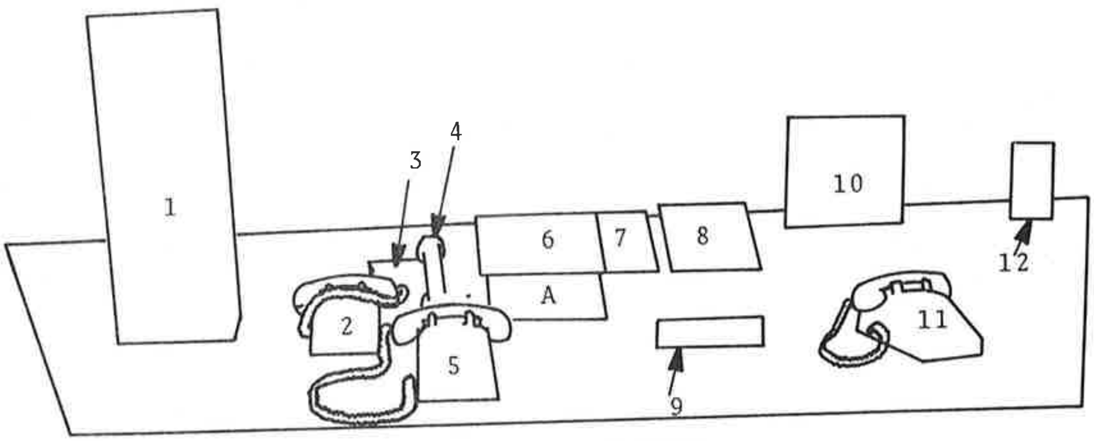


CD CLEARANCE DELIVERY
FD FLIGHT DATA
LC LOCAL CONTROL
GC GROUND CONTROL

CC CAB COORDINATOR
TS TEAM SUPERVISOR

FIGURE 2-40. TOWER CAB LAYOUT





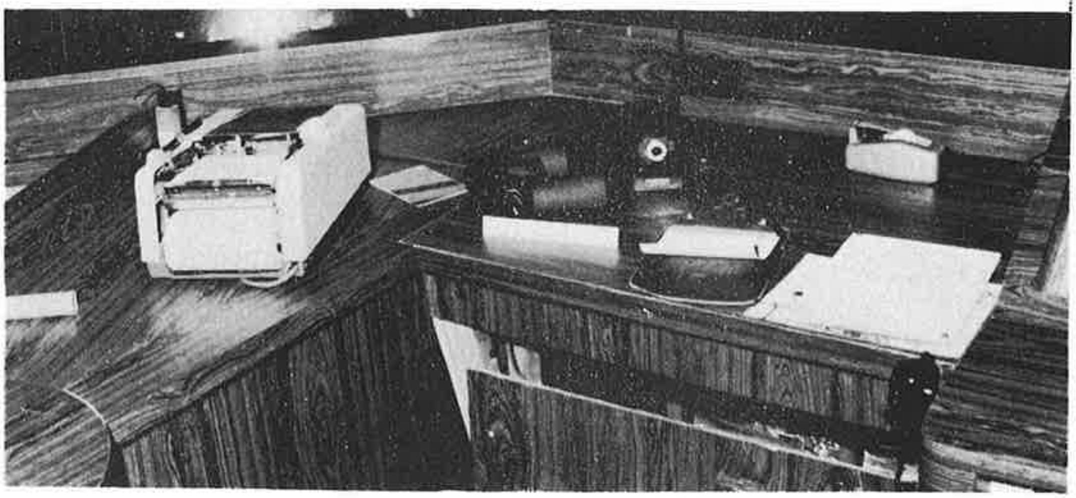
PAPER

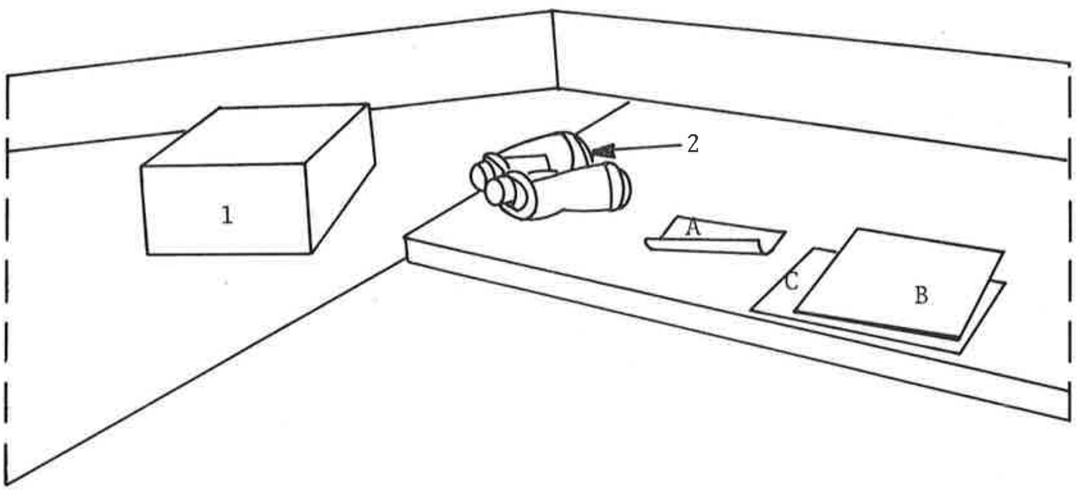
A. TELEPHONE CODES

DEVICES

1. COFFEE MACHINE
2. TELPHONE, FLOW CONTROL TO WASH. DC
3. ELECTRICAL OUTLET
4. TELEPHONE,
5. TELEPHONE, REGULAR COMMERCIAL PHONE
6. TELCO KEYPACK
7. TELCO DIAL BOX
8. TELCO SPEAKER
9. TELCO JACK PANEL
10. RADIO TO AIRPORT VEHICLES FROM CITY OF ALANTA
11. TELPHONE,
12. AM/FM RADIO

FIGURE 2-41. TS (TEAM SUPERVISOR) POSITION LAYOUT





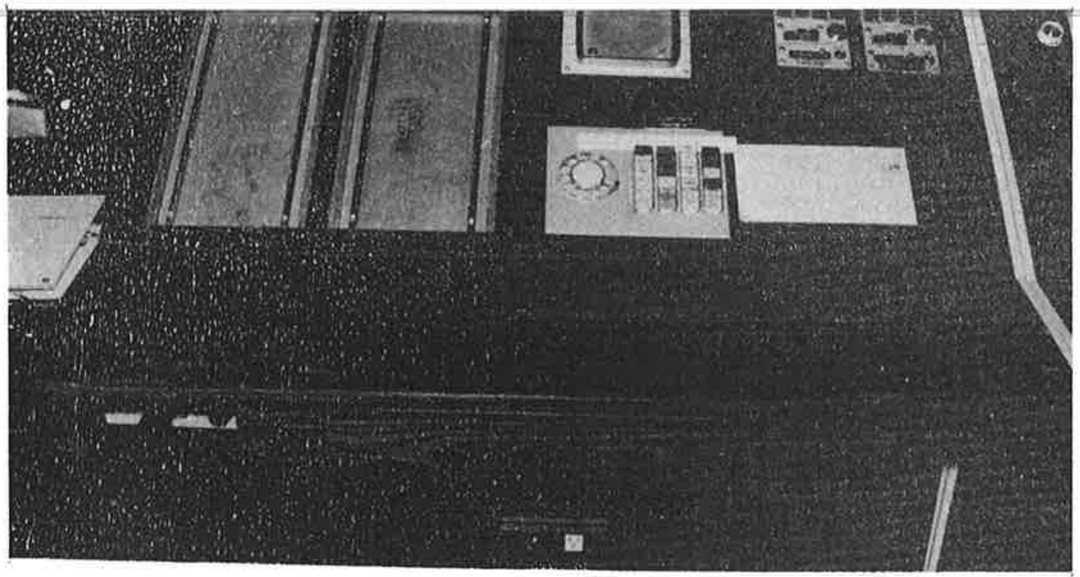
DEVICES

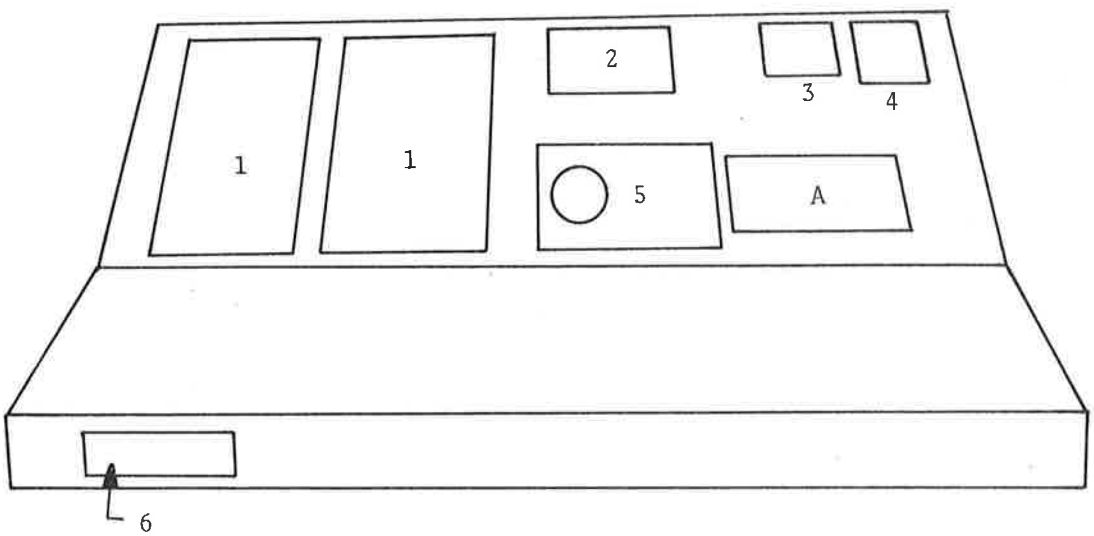
1. ELECTRO WRITER
2. BINOCULARS

PAPER

A. ATL WEATHER REPORT
B. ATIS FORMAT SHEET
C. TAXIWAY MAP

FIGURE 2-42. CONSOLE AREA TO LEFT OF FLIGHT DATA POSITION CONTAINING AN ELECTROWRITER





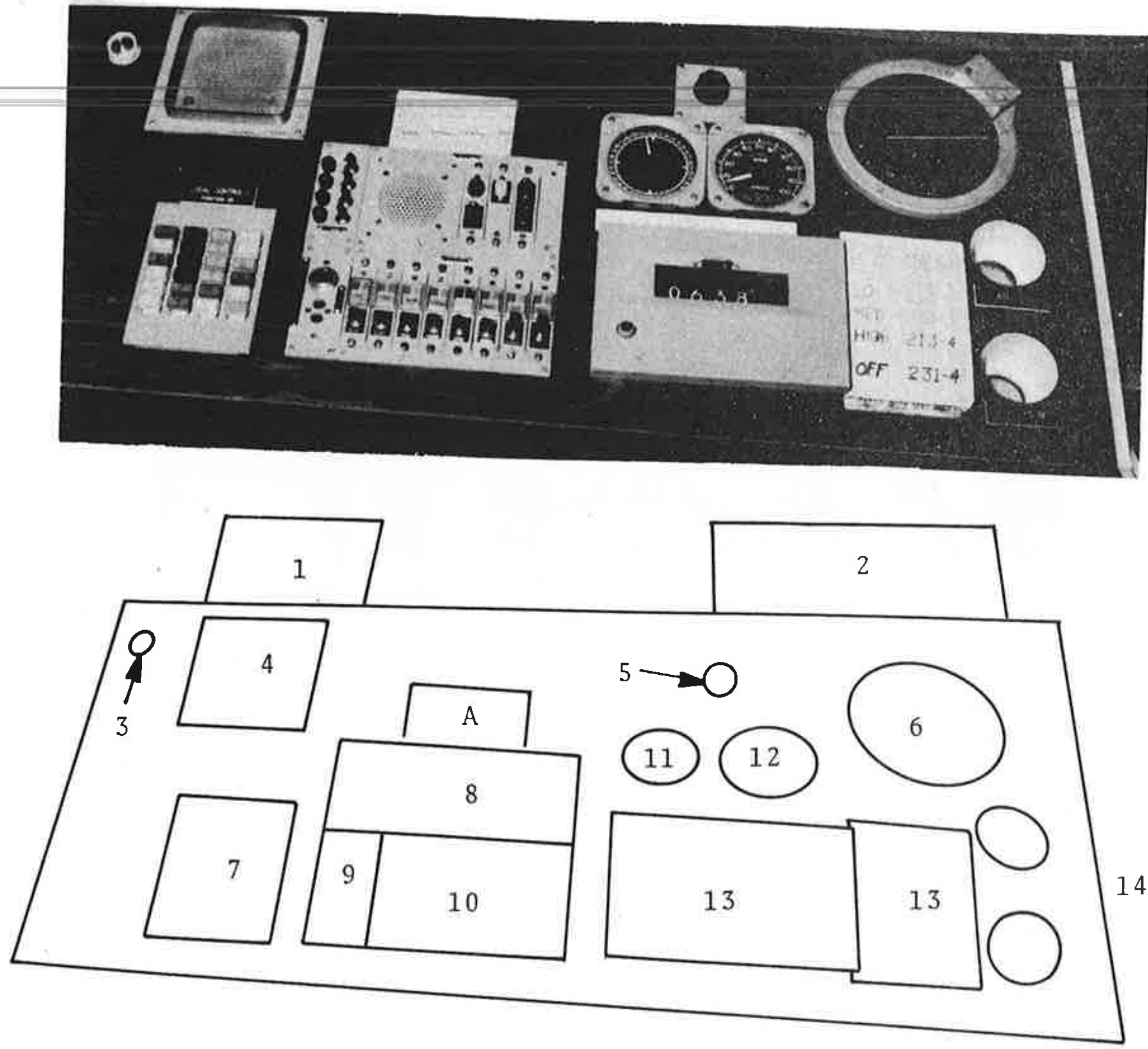
DEVICES

1. STRIP BAY
2. TELCO SPEAKER
3. INBOUND ATIS
4. OUTBOUND ATIS
5. TELCO DIAL BOX & KEY PACK
6. PHONE JACK

POSTED PAPER

A. TELEPHONE NUMBERS

FIGURE 2-43. FD (FLIGHT DATA) POSITION LAYOUT



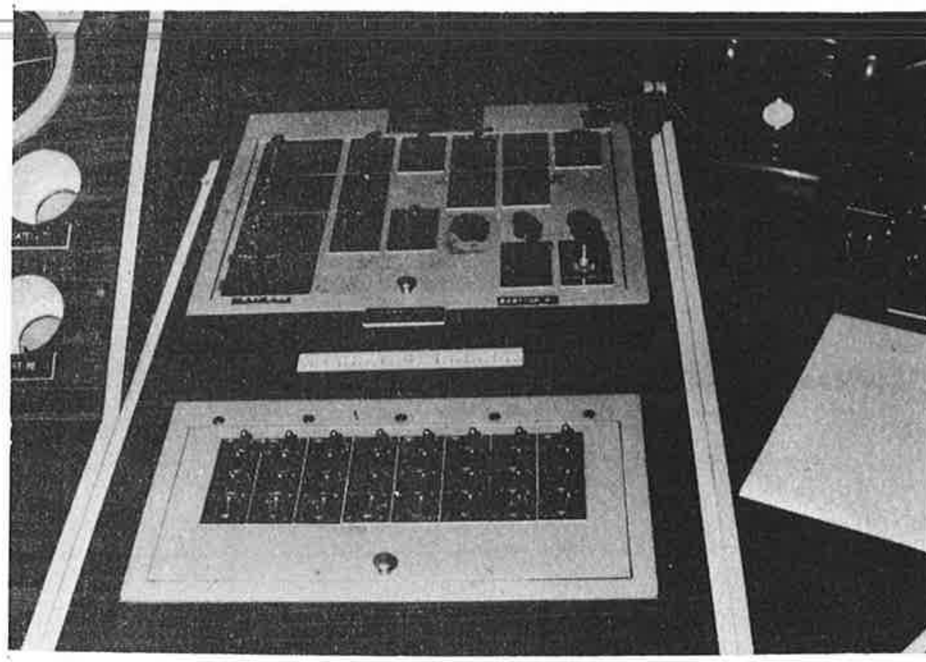
DEVICES

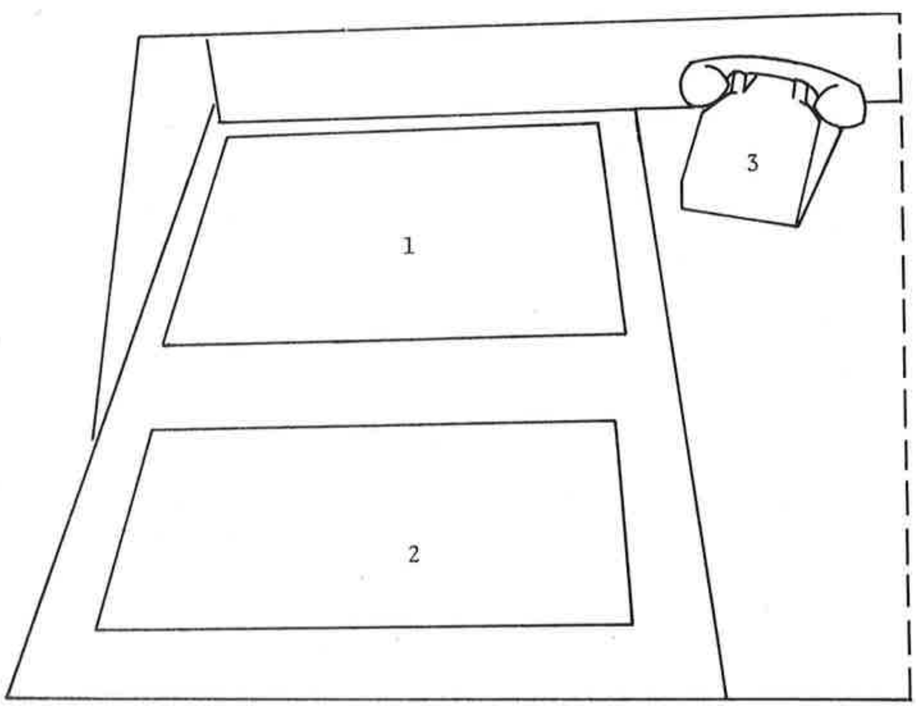
1. WINDSHEAR INDICATOR
2. MALS CONTROLS
3. RHEOSTAT, OVERHEAD LIGHTS
4. TELCO SPEAKER
5. BACKLIGHT CONTROL FOR WIND INSTRUMENTS
6. ALTIMETER
7. TELCO KEYPACK
8. FAA AUDIO MODULE
9. FAA MIKE JACK
10. FAA FREQUENCY SELECTION PANEL
11. WIND DIRECTION INDICATOR
12. WIND VELOCITY INDICATOR
13. CLOCK
14. STRIP DELIVERY TUBES TO TRACON

POSTED PAPER

A. ALTERNATE RADIO FREQ.
B. MALS BRIGHTNESS SETTINGS

FIGURE 2-44. LC-1 (LOCAL CONTROL) POSITION LAYOUT

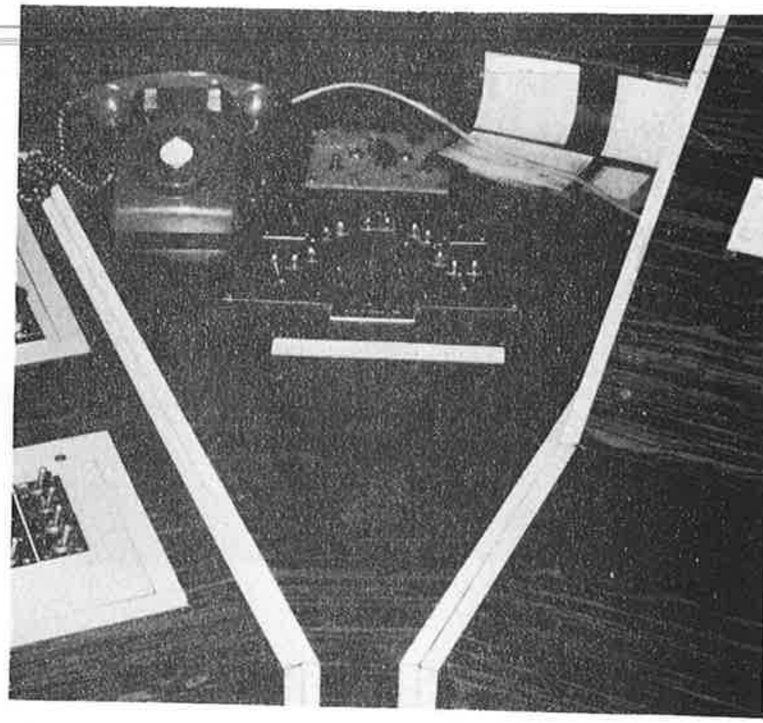


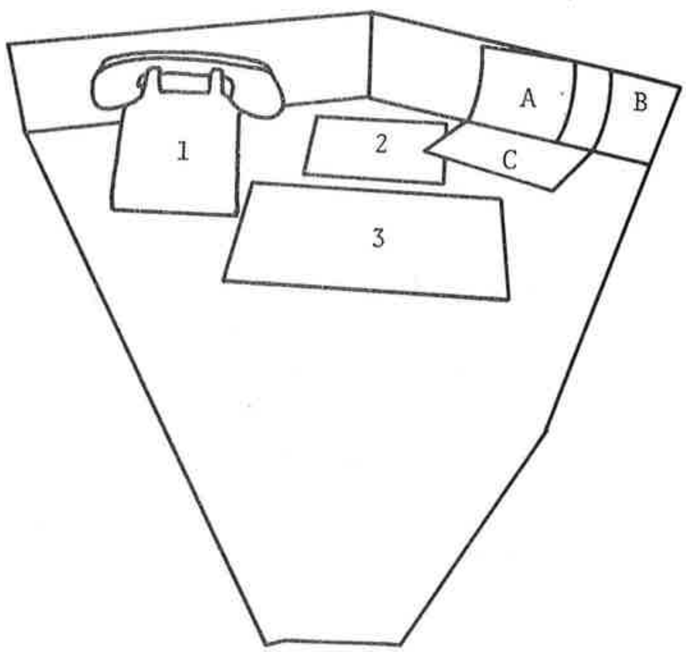


DEVICES

1. RUNWAY LIGHTING
2. TAXIWAY LIGHTING
3. TELEPHONE

FIGURE 2-45. AIRPORT LIGHTING PANELS LOCATED BETWEEN LC-1 AND LC-2

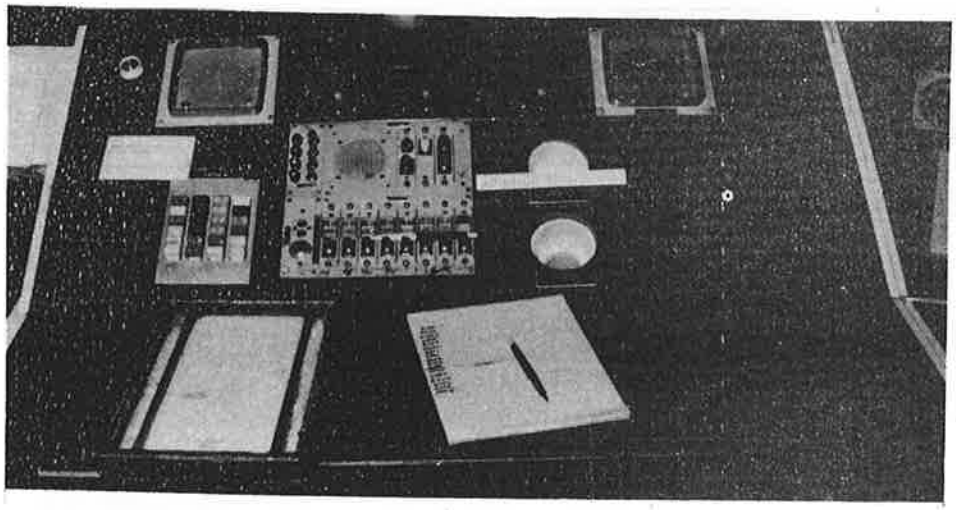


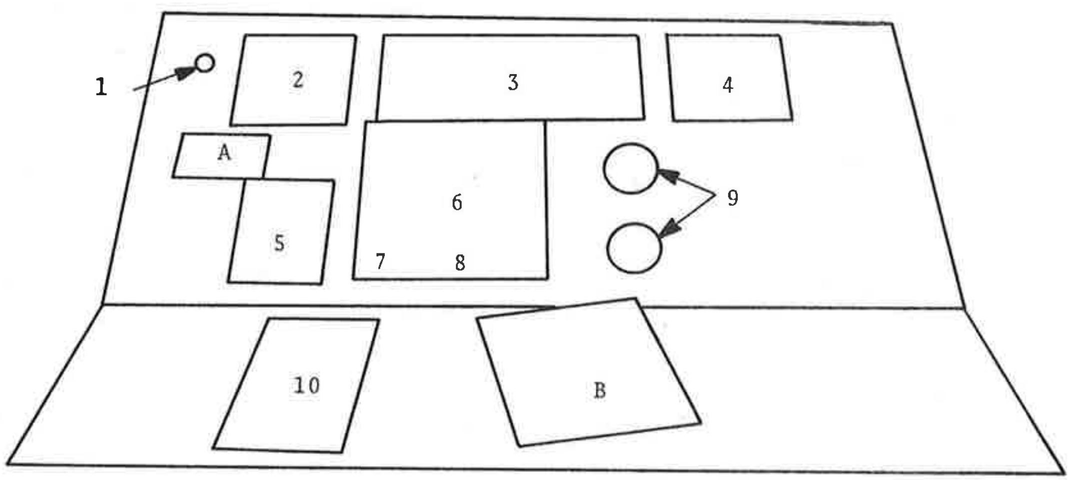


DEVICES

1. TELEPHONE
2. VISUAL APPROACH SLOPE INDICATOR (VASI) PANEL
3. APPROACH LIGHTING SYSTEM (ALS) PANEL

FIGURE 2-46. ALC/BASI PANELS LOCATED BETWEEN LC-1 AND LC-2





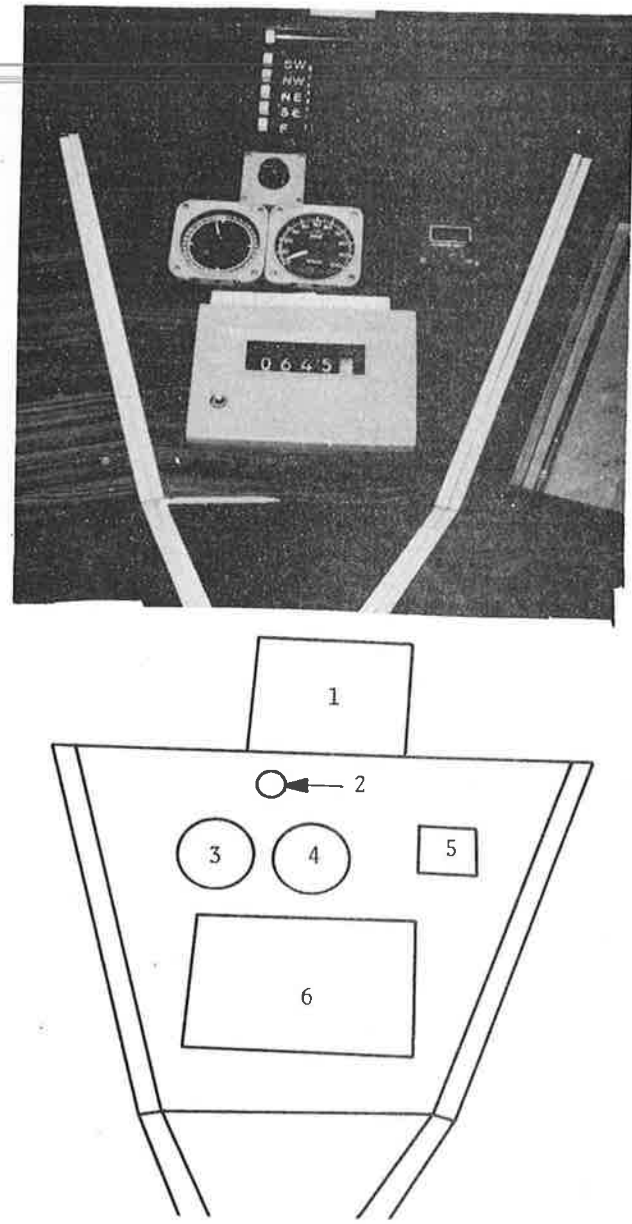
DEVICES

1. RHEOSTAT OVERHEAD LIGHTS
2. TELCO SPEAKER
3. RVR DISPLAY CONTROLS
4. TELCO SPEAKER, HOTLINE
5. TELCO KEYPACK
6. FAA AUDIO MODULE
7. FAA JACK PANEL
8. FAA FREQUENCY SELECTION PANEL
9. STRIP DELIVERY TUBES TO TRACON
10. STRIP TRAY

PAPER

A. STANBY RADIO FREQ.
B. SCRATCHPAD

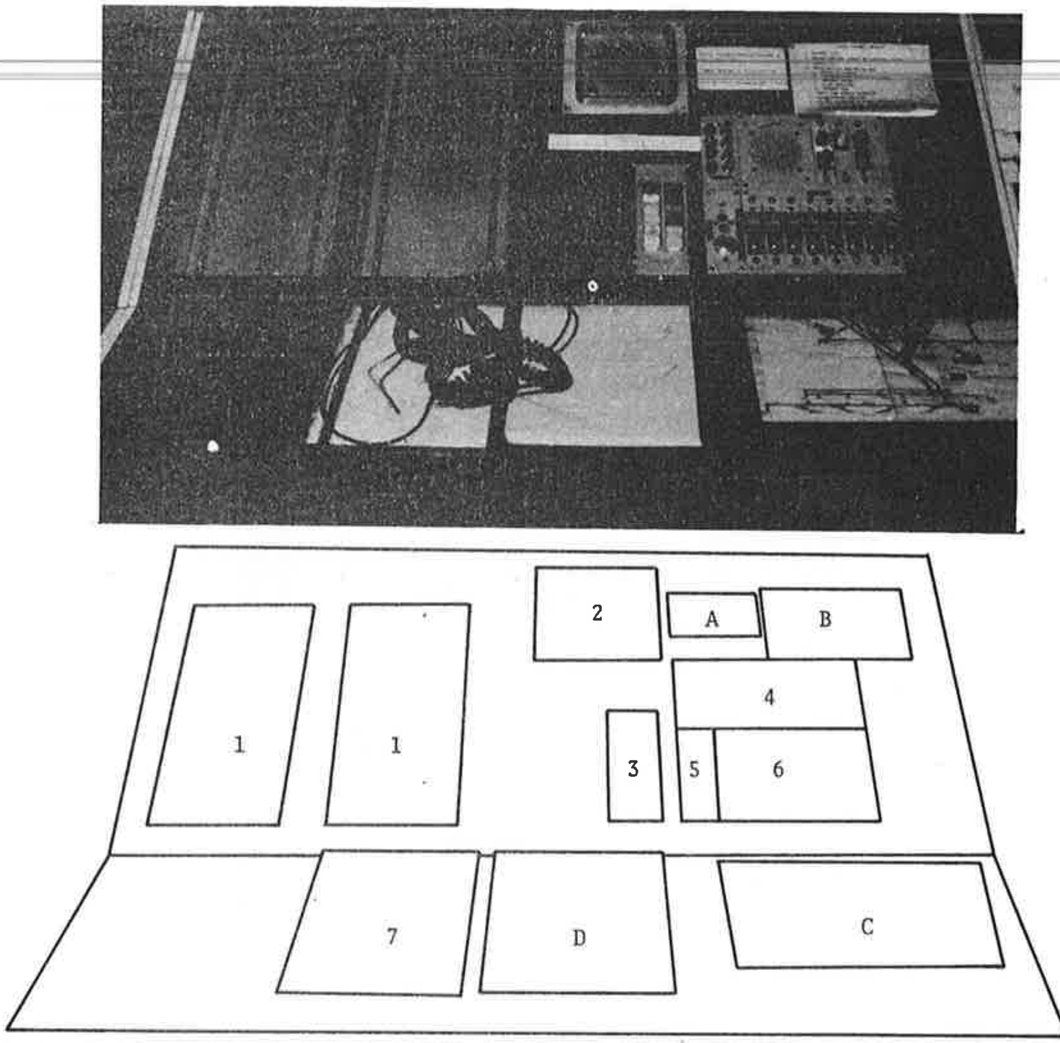
FIGURE 2-47. LC-2 (LOCAL CONTROL) POSITION LAYOUT



DEVICES

1. WINDSHEAR INDICATOR
2. BACKLIGHT CONTROL FOR WIND INSTRUMENTS
3. WIND DIRECTION INDICATOR
4. WIND VELOCITY INDICATOR
5. ALTIMITER
6. CLOCK

FIGURE 2-48. WEATHER DEVICES LOCATED BETWEEN LC-2 AND GC-3



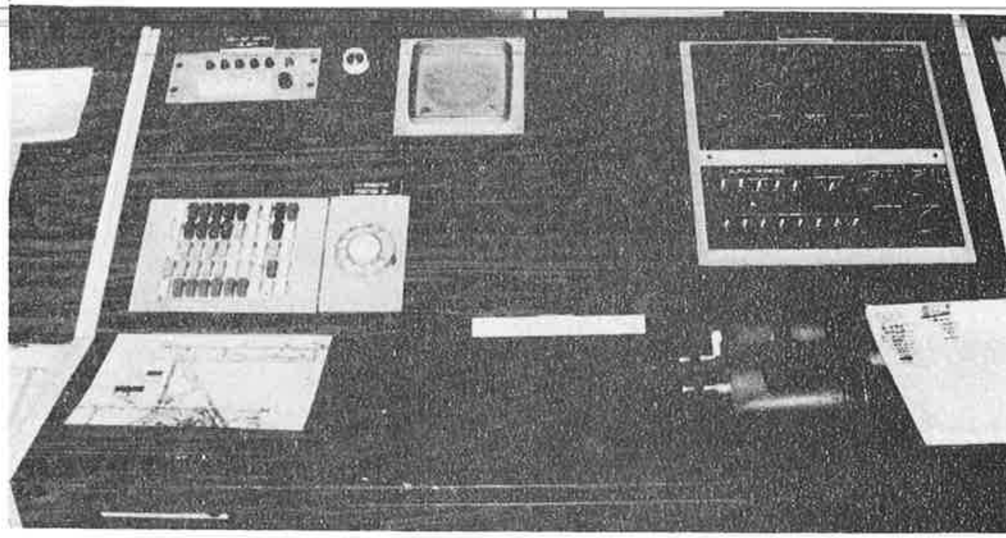
DEVICES

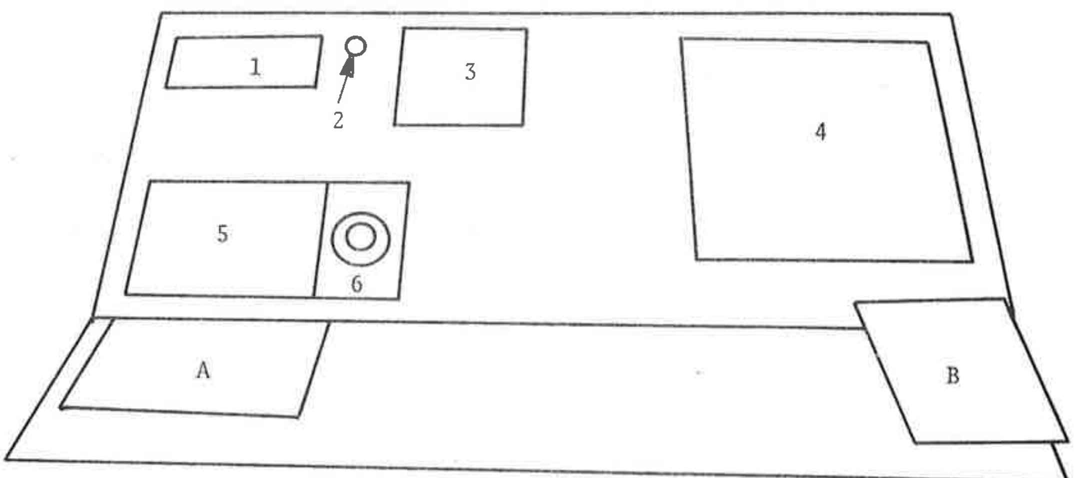
1. STRIP BAY
2. TELCO SPEAKER
3. TELCO KEY PACK
4. FAA AUDIO MODULE
5. FAA MIKE PANEL
6. FAA FREQUENCY SELECTION PANEL
7. PORTABLE STRIP TRAY

PAPER

A. FAA FREQUENCY LOCATIONS
B. CONTROL PERSONNEL CHECKLIST
C. RUNWAY/TAXIWAY MAP
D. SCRATCHPAD

FIGURE 2-49. GC-3 (GROUND CONTROL) POSITION LAYOUT





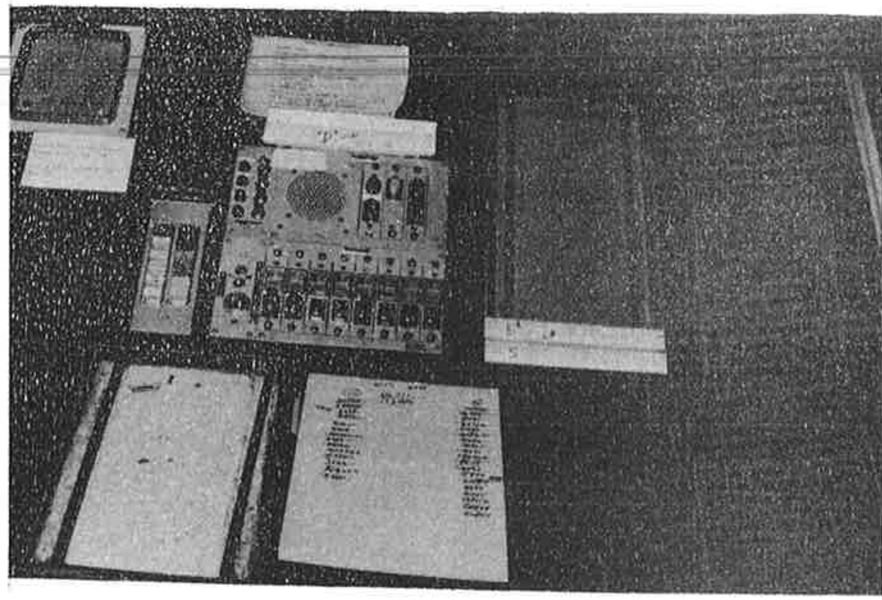
DEVICES

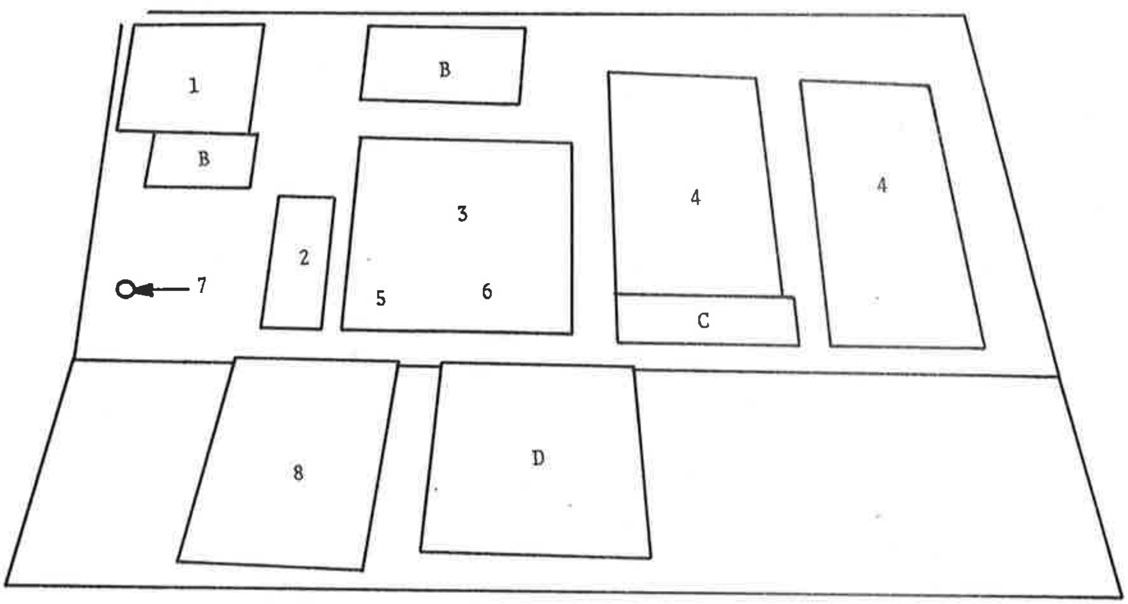
1. ASR MAP CONTROL
2. RHEOSTAT, OVERHEAD LIGHTS
3. TELCO SPEAKER
4. BRITE CONTROL
5. TELCO KEYPACK
6. TELCO DIAL BOX

PAPER

A. RUNWAY/TAXIWAY MAP
B. SCRATCHPAD

FIGURE 2-50. CC (CAB COORDINATOR) POSITION LAYOUT





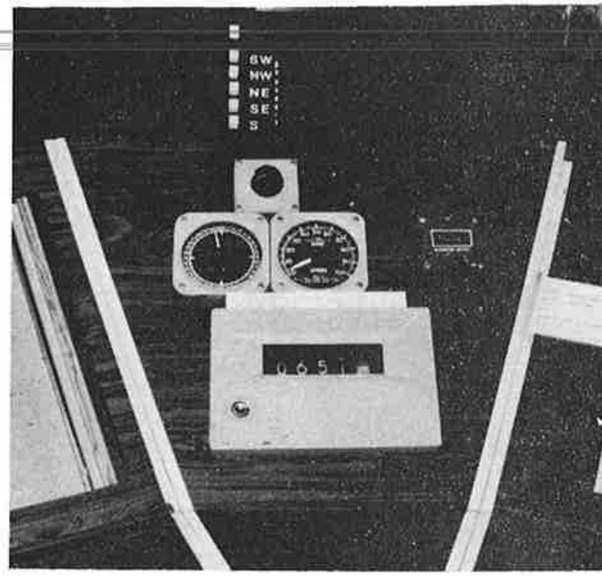
DEVICES

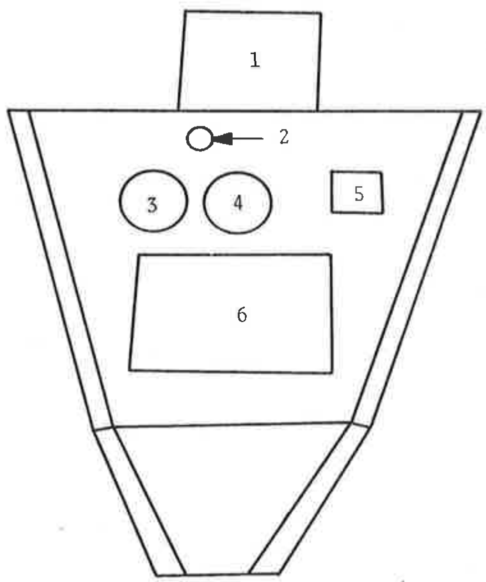
1. TELCO SPEAKER
2. TELCO KEYPACK
3. FAA AUDIO MODULE
4. STRIP BAY
5. FAA MIKE JACK
6. FAA FREQUENCY SELECTION PANEL
7. RHEOSTAT, OVERHEAD LIGHTS
8. PORTABLE STRIP TRAY

PAPER

A. FAA FREQ. LOCATIONS
B. CONTROL PERSONNEL CHECKLIST
C. FLIGHT STRIPS
D. SCRATCHPAD

FIGURE 2-51. GC-2 (GROUND CONTROL) POSITION LAYOUT

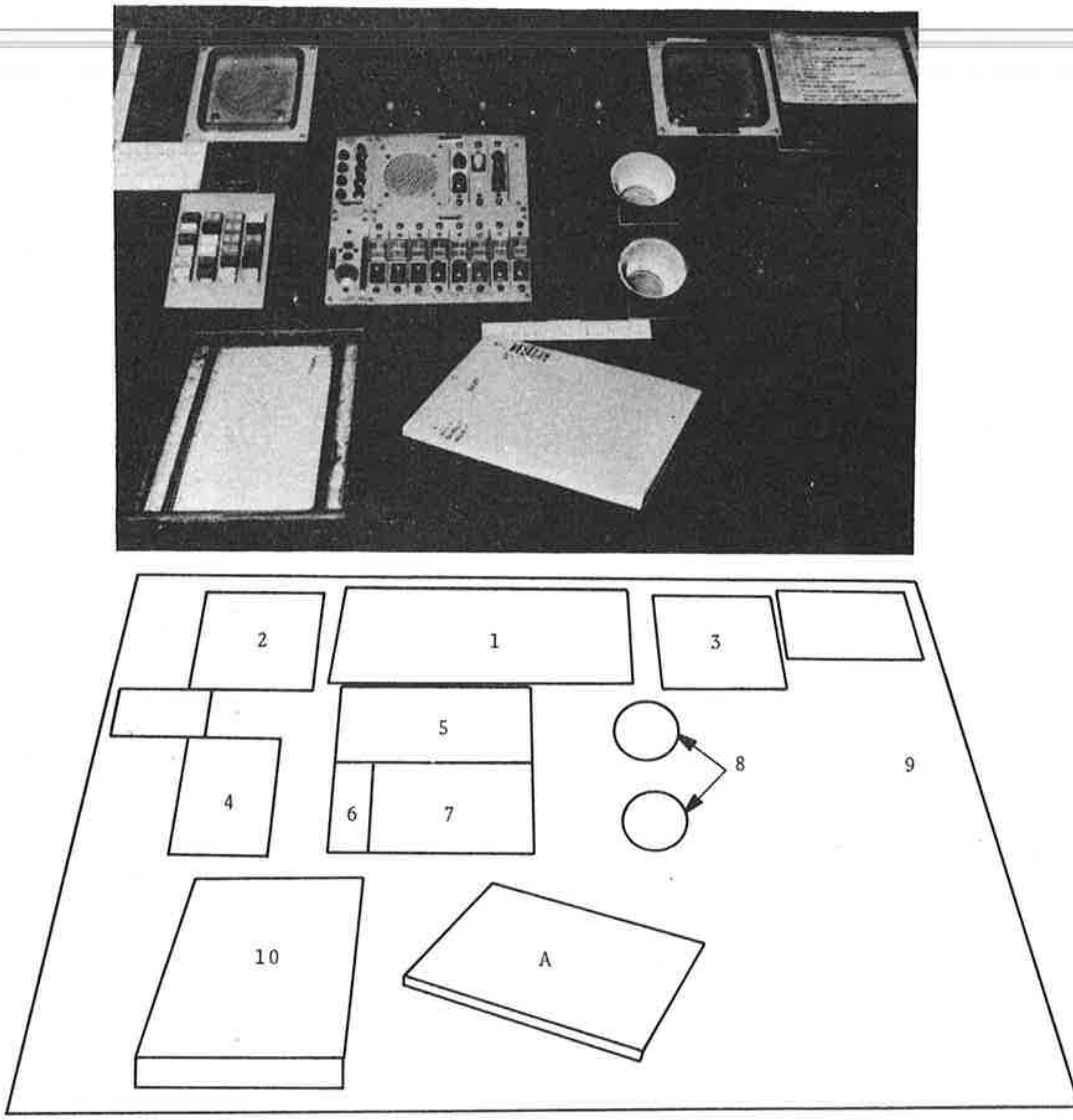




DEVICES

1. WINDSHEAR INDICATOR
2. BACKLIGHT CONTROL FOR WIND INSTRUMENTS
3. WIND DIRECTION INDICATOR
4. WIND VELOCITY INDICATOR
5. ALTIMETER
6. CLOCK

FIGURE 2-52. WEATHER DEVICES LOCATED BETWEEN GC-2 AND LC-3



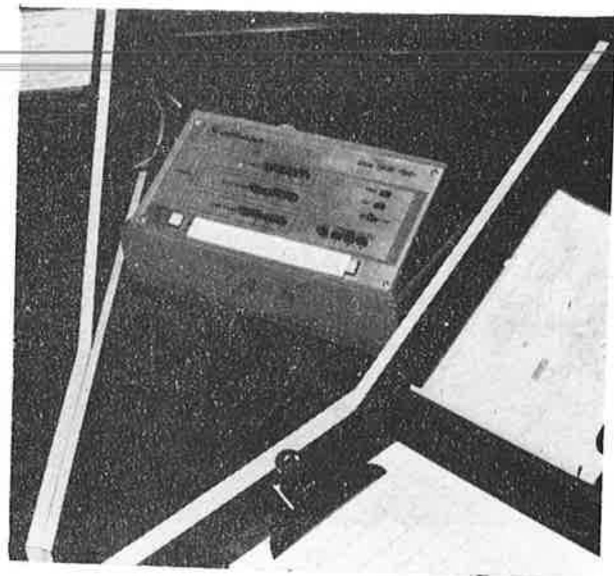
DEVICES

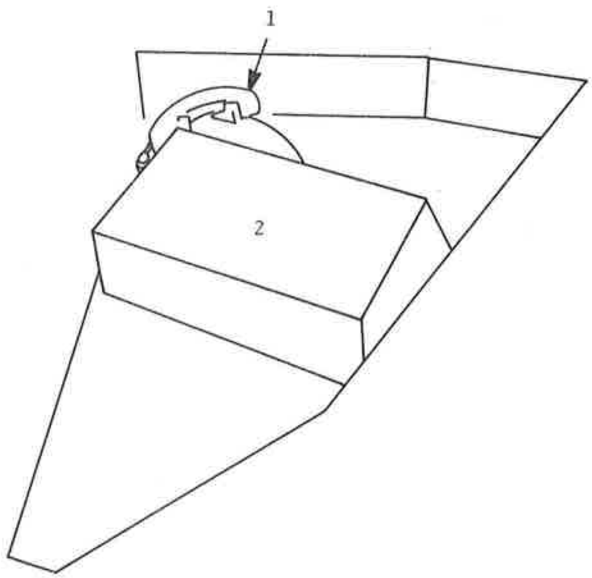
1. RVR DISPLAY
2. TELCO SPEAKER
3. TELCO SPEAKER, HOTLINE
4. 300SS TELCO KEYBOARD
5. AUDIO MODULE
6. FAA MIKE PANEL
7. FREQUENCY SELECTOR MODULE
8. STRIP DELIVERY TUBES
9. ALS CONTROL PANEL RNWY 8
10. PORTABLE STRIP IRAY

POSTED PAPER

A. SCRATCHPAD

FIGURE 2-53. LC-3 (LOCAL CONTROL) POSITION LAYOUT

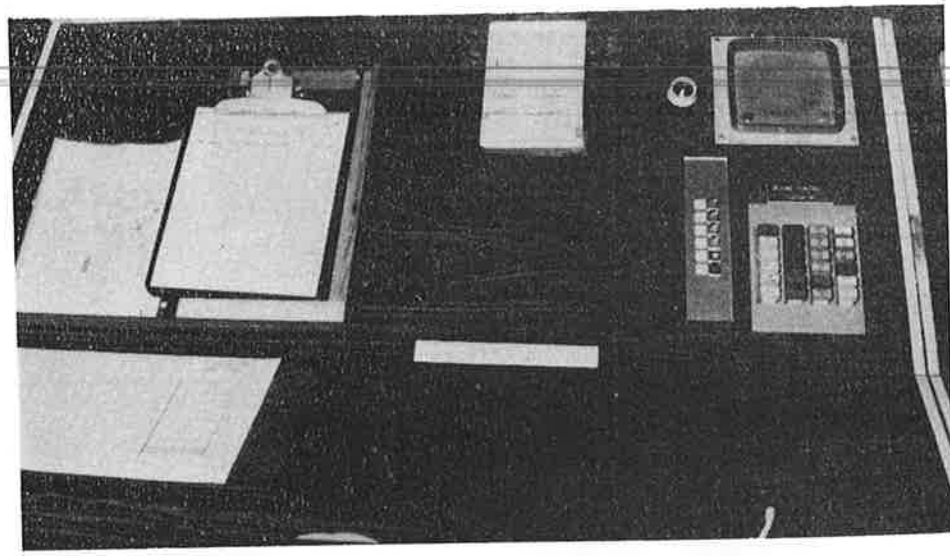


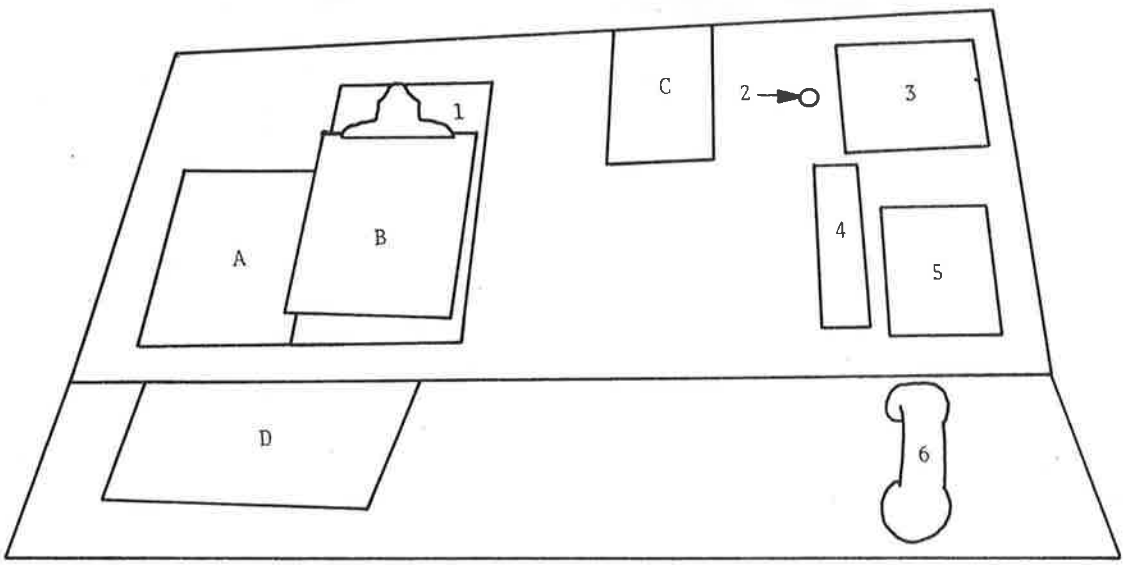


DEVICES

1. TELEPHONE
2. MALS CONTROL PANEL

FIGURE 2-54. MALS PANEL LOCATED BETWEEN LC-3 AND GC-1





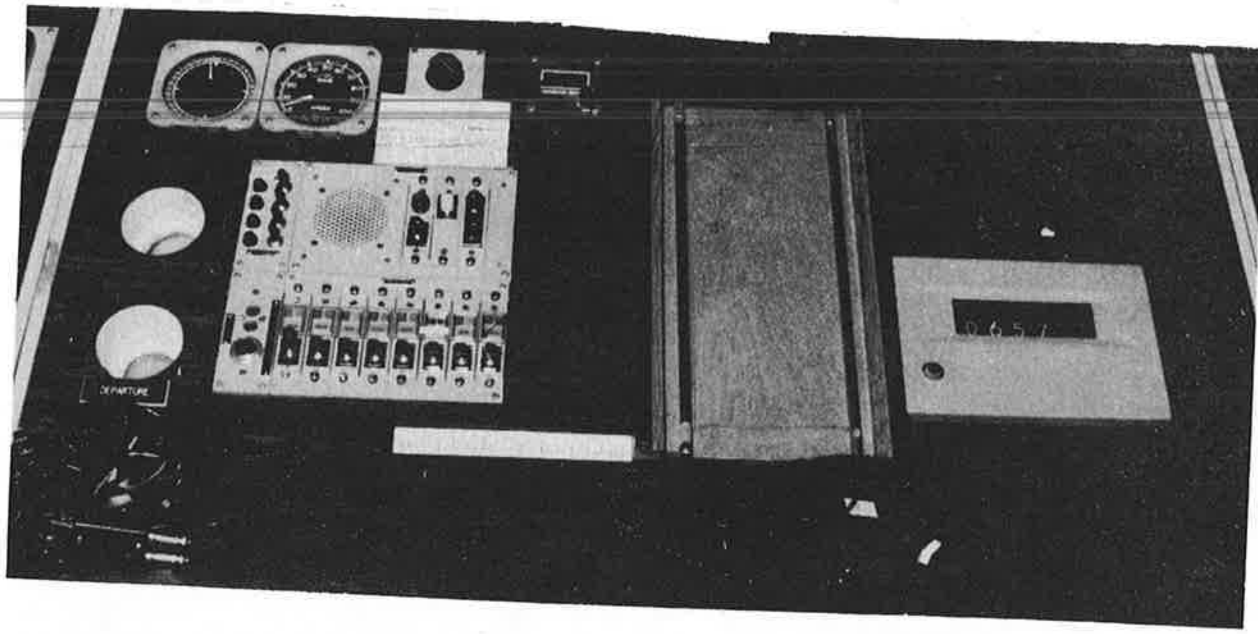
DEVICES

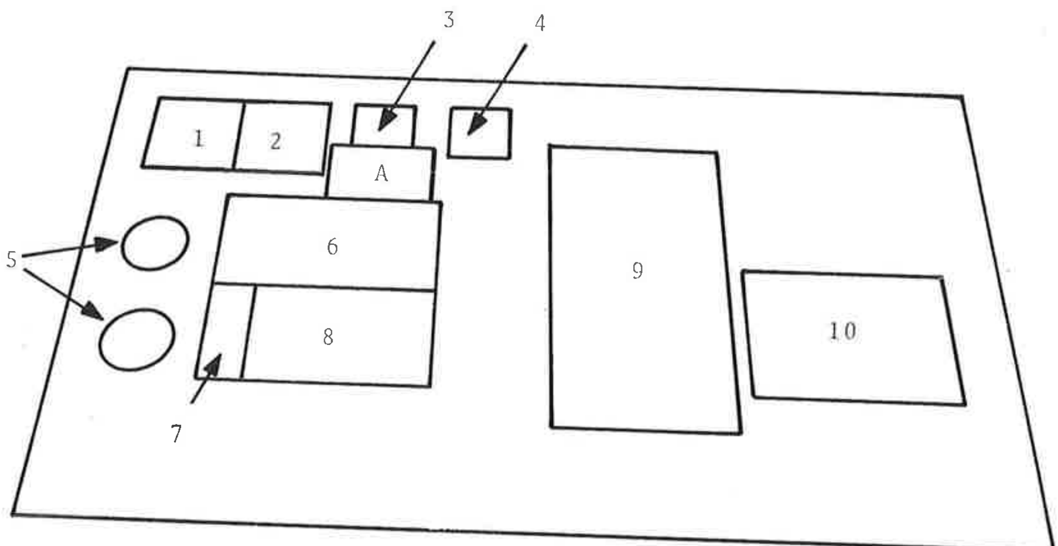
1. STRIP BAY
2. RHEOSTAT, OVERHEAD LIGHTS
3. TELCO SPEAKER
4. TELCO TO RAMP TOWERS EASTERN & DELTA
5. TELCO KEYPACK
6. TELEPHONE

PAPER

A. RUNWAY/TANWAY MAP
B. CONTROLLER POSITION SIGN-ON LOG
C. MALS BRIGHTNESS SETTINGS
D. TRAFFIC COUNT SHEET (FOR GATE HOLD PROCEDURES)

FIGURE 2-55. GC-1 (GROUND CONTROL) POSITION LAYOUT





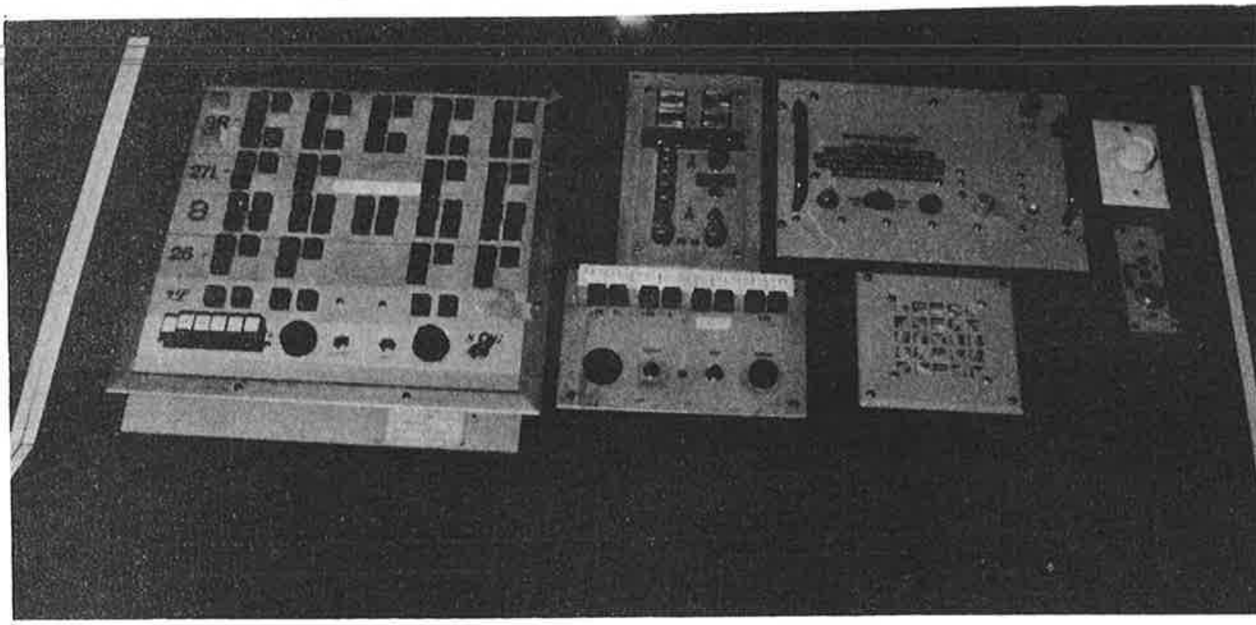
DEVICES

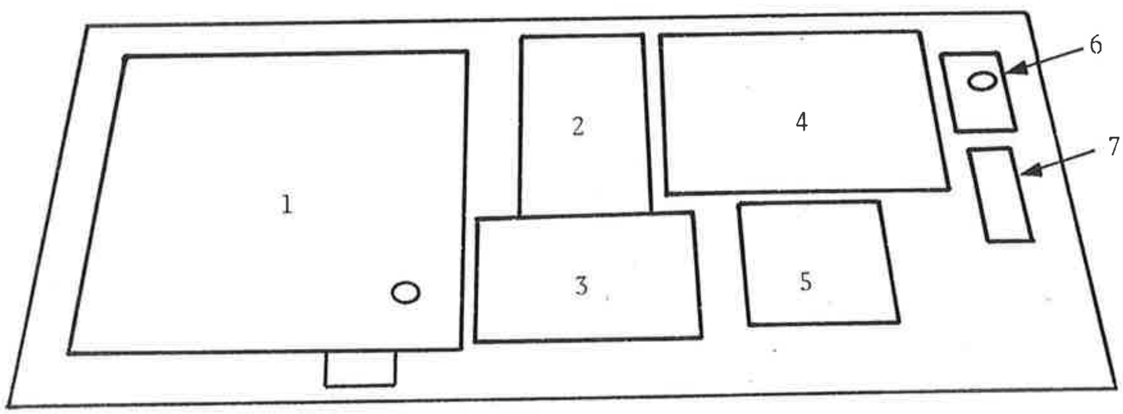
1. WIND DIRECTION
2. WIND VELOCITY
3. RHEOSTAT FOR WIND INSTR. LIGHTING
4. ALTIMETER
5. STRIP DELIVERY TUBES
6. AUDIO MODULE
7. FAA MIKE PANEL
8. FREQUENCY SELECTOR MODULE
9. STRIP BAY
10. CLOCK

POSTED PAPER

A RAPID FREQUENCIES

FIGURE 2-56. LC-4 (LOCAL CONTROL) POSITION LAYOUT





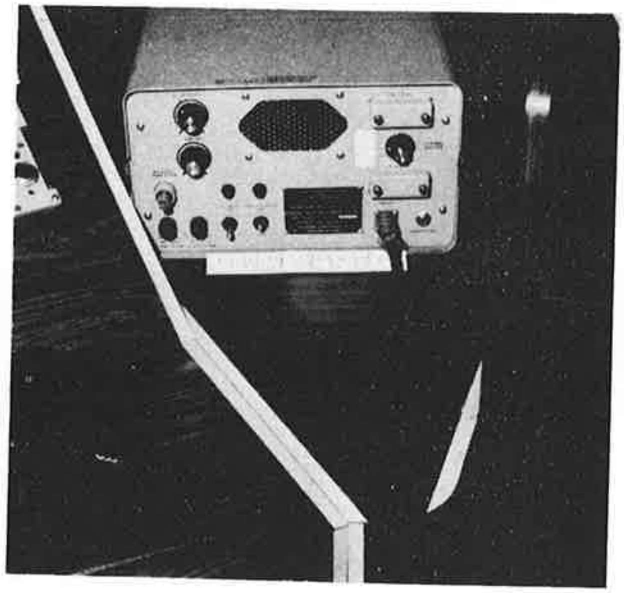
DEVICE

1 ILS ALARM CONSOLE
2 ASPE CONTROL PANEL
3 LOM-VOT MONITOR PANEL
4 ALTITUDE ALARM CONTROL PANEL
5 SPEAKER FOR ALT ALARM
6 RHEOSTAT OVERHEAD LIGHTS
7 MIKE&HEADSET JACKS

PAPER

A ILS PANEL INSTRUCTION SHEET

FIGURE 2-57. VARIOUS MONITOR PANELS LOCATED IN CONSOLE TO RIGHT OF LC-3 POSITION



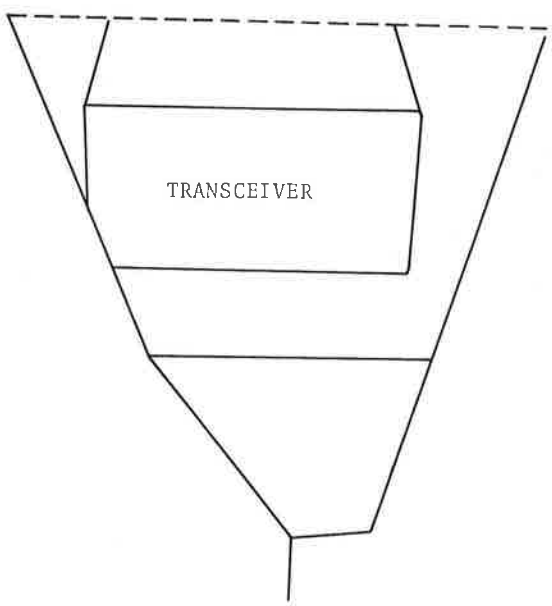


FIGURE 2-58. BACKUP VHF CONTROLLER TO PILOT TRANSCEIVER LOCATED IN CORNER TO RIGHT OF LC-4

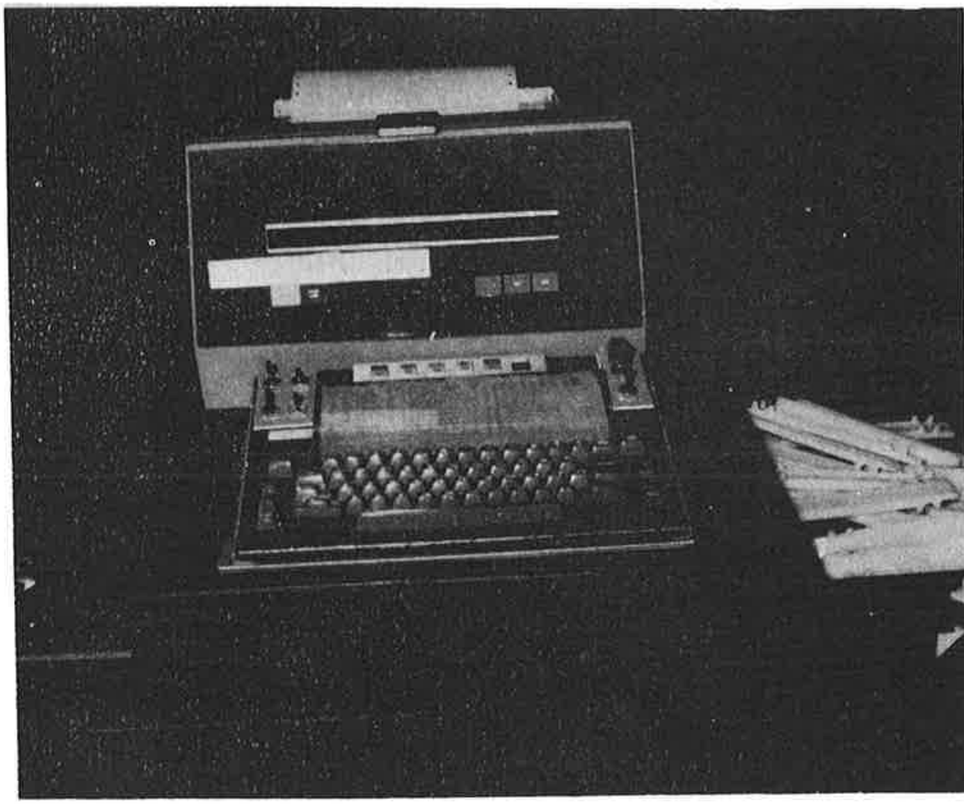
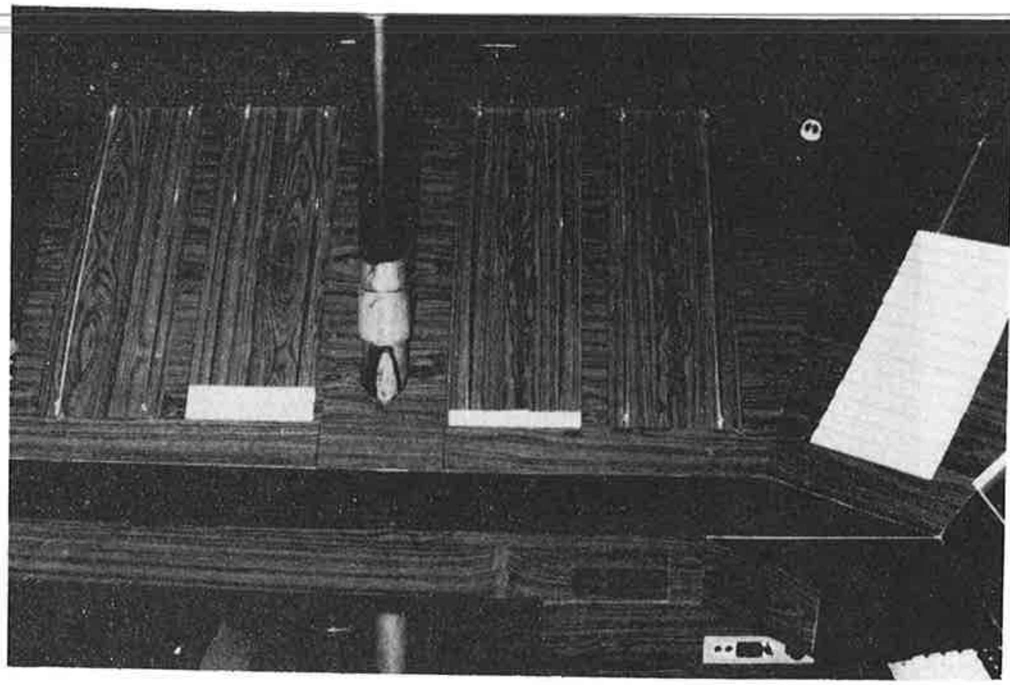
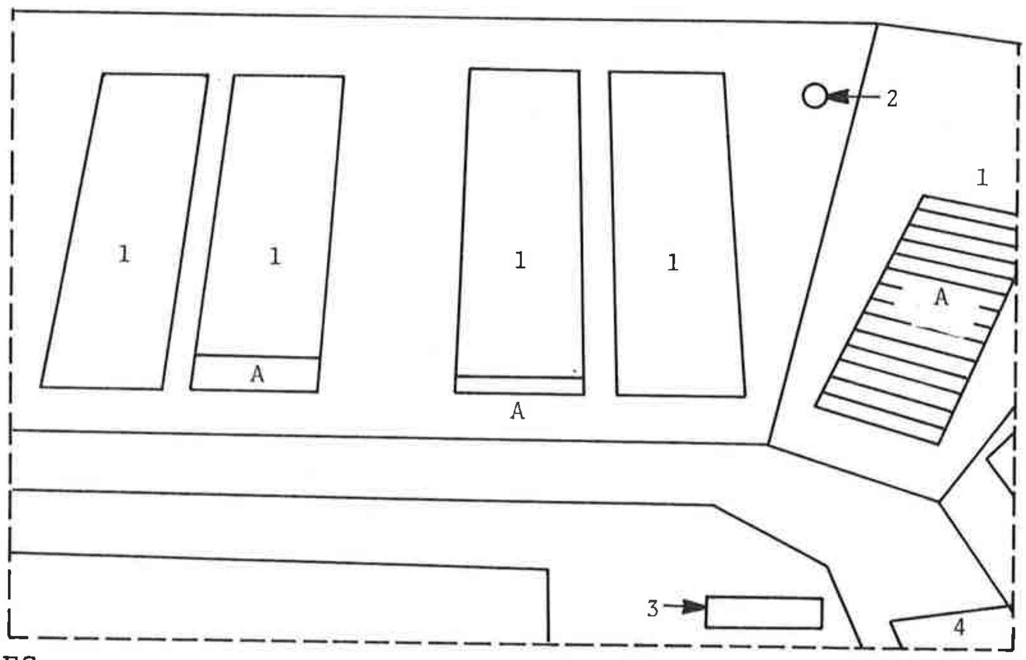


FIGURE 2-59. CD'S (CLEARANCE DELIVERIES) LEFT HAND OF CONSOLE LAYOUT - THE FLIGHT DATA ENTRY AND PRINTOUT (FDEP) UNIT





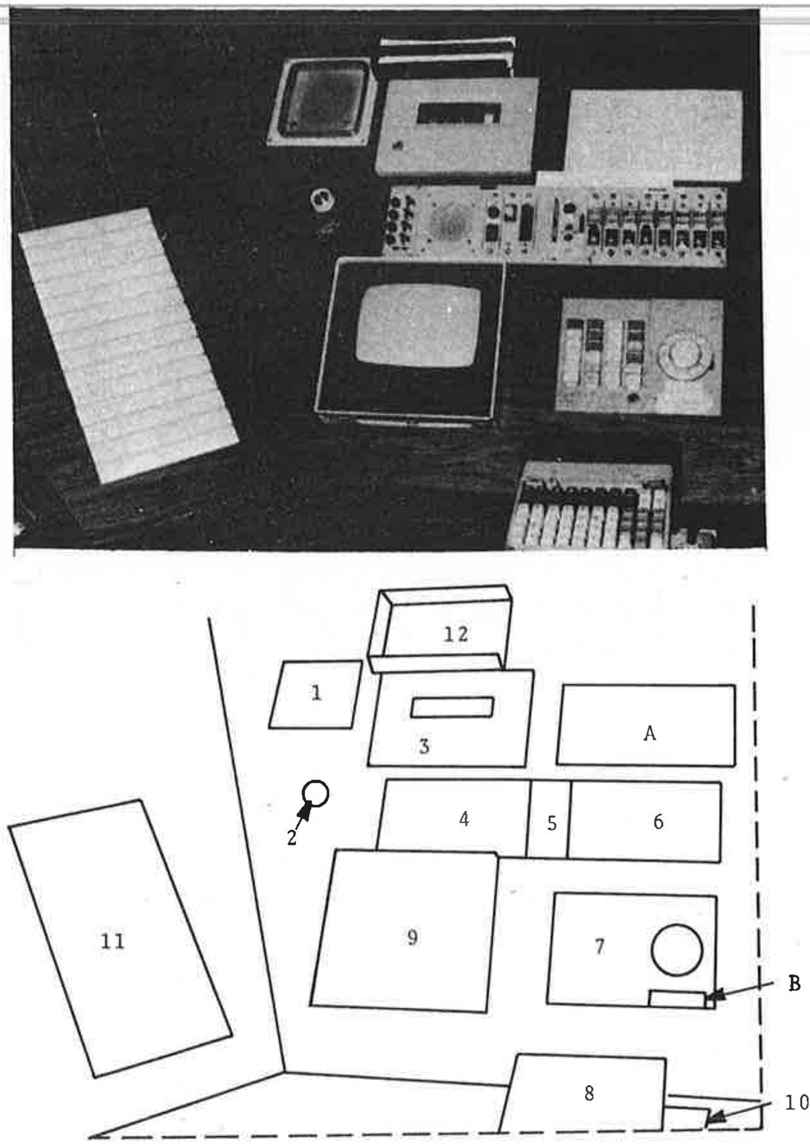
DEVICES

1. STRIP BAY
2. RHEOSTAT OVERHEAD LIGHTS
3. PHONE JACK
4. ARTS KEYBOARD

PAPER

A. FLIGHT STRIPS

FIGURE 2-60. CD (CLEARANCE DELIVERY) POSITION LAYOUT



DEVICES

1. TELCO SPEAKER
2. RHEOSTAT OVERHEAD LIGHT
3. DIGITAL CLOCK
4. AUDIO MODULE
5. FAA MIKE PANEL
6. FREQUENCY SELECTOR MODULE
7. TELCO KEYPACK & DIAL BOX
8. A/N DATA ENTRY DEVICE
9. MONITOR
10. ENTER BUTTON & PEM STICK
11. FLIGHT STRIPS
12. FLIGHT STRIP STORAGE BIN

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A. TEL DIAL CODES
B. GATEHOLD FREQ.

FIGURE 2-61 CD'S (CLEARANCE DELIVERY) RIGHT HAND CONSOLE

3. CANDIDATE CONSOLIDATED CAB DISPLAY EQUIPMENT

The characteristics of weather displays and lighting control panels to be considered in the Consolidated Cab Display design (CCD) are described in this section from the controller's point of view. The tower locations, users, manner of use, a picture, and physical description are presented for each piece of equipment.

3.1 OPERATIONAL DISPLAY INFORMATION

(1) Time, digital clock (Figure 3-1)

A. Characteristics

Shows Greenwich mean time (Zulu time)
Hours 00 to 23, two digits
Minutes 00 to 60, two digits
Seconds 00 to 60, on drum
Digits approximately 0.5" high by 0.375" wide
Clock panel approximately 6.5" high, 9.5" wide

B. Deployment in TRACON

Locations: (Figure 3-2)

DH-1 (Departure Handoff)
DH-2
DH-4
SATH-3 (Satellite Handoff)
AH-3 (Arrival Handoff)
AC (Assistant Chief)

Users - AH-2 records time that he broadcasts SIGMET's on the back of the flight strip containing the weather information. He obtains the time from the TAR-2 ARTS display.

In the past, Arrival Handoff Controllers recorded the time of handoff of aircraft from the enroute center to the TRACON (ARTS handoff). They are now experimenting with not doing this. Also the TAR positions record times on flight strips when they have to hold aircraft back to maintain appropriate spacing of arrival aircraft.

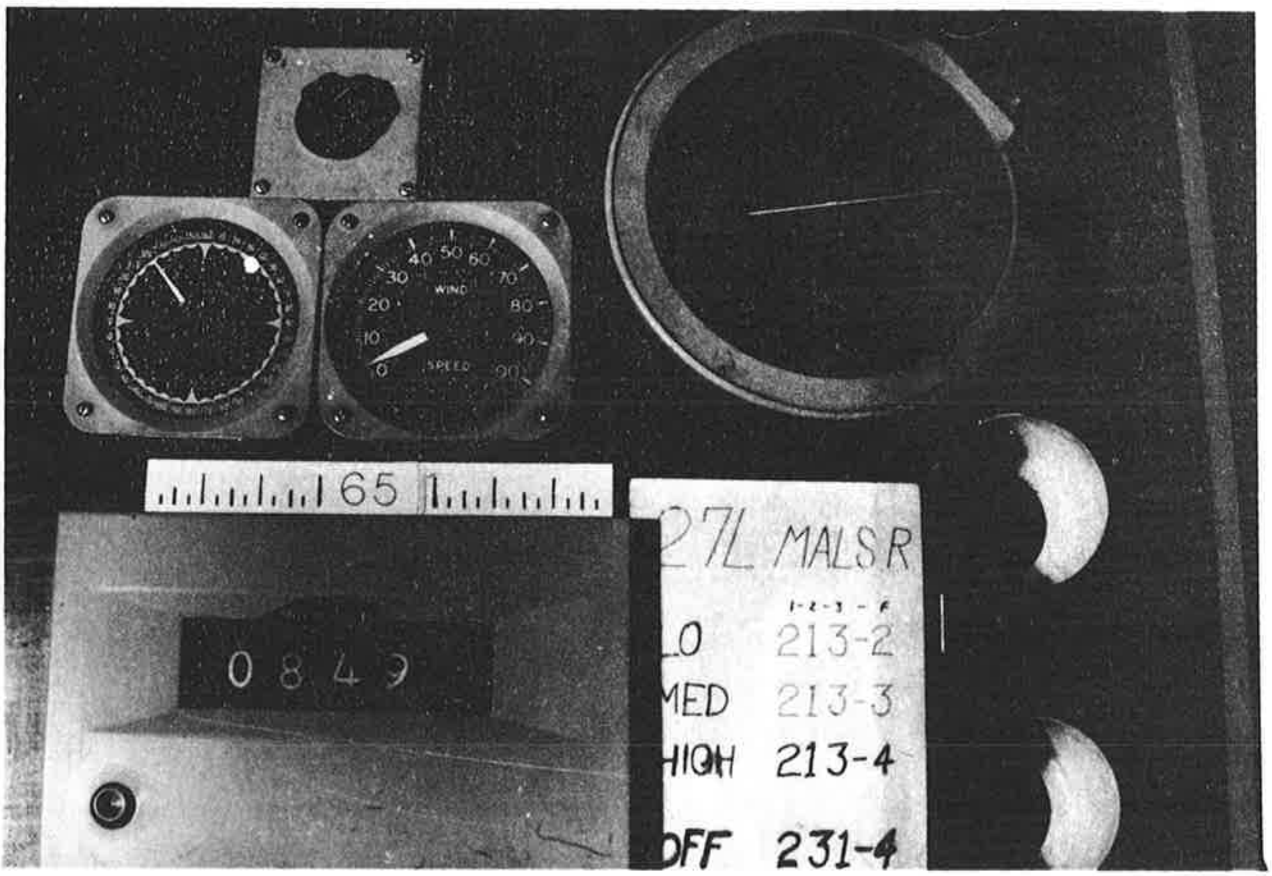


FIGURE 3-1. WEATHER INSTRUMENT CLUSTER IN CAB, INCLUDING WIND DIRECTION AND VELOCITY, ANALOG ALTIMETER, AND DIGITAL CLOCK

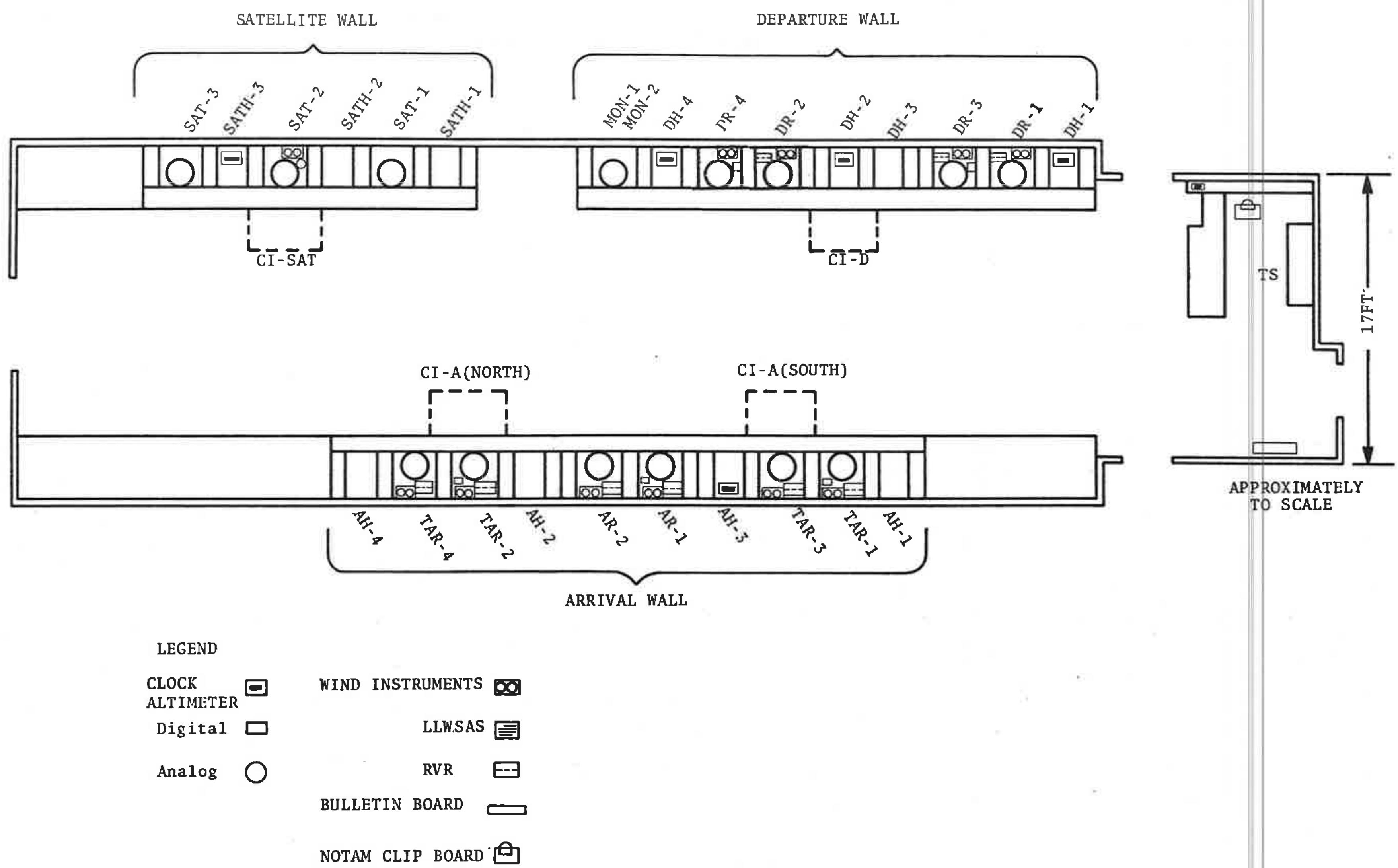


FIGURE 3-2. LOCATION OF WEATHER EQUIPMENT IN TRACON

Only one of the AH positions has a clock and none of the TAR positions do. In either case, controllers prefer to get their time information from the nearest ARTS display. Because of the location of the clocks in the TRACON (Figure 3-3) and the fact that the numbers are recessed beneath the clock case, even those who have clocks prefer not to use them because they must get up from their chairs to do so. Of course, the clocks must be used during the mid-shift when the ARTS is down for maintenance.

C. Deployment in cab

Locations: (Figure 3-4)

FD (Flight Data)
LC-1 (local Control)
LC-2
LC-3
LC-4

Users - Local and Ground Controllers need time primarily for pilot time checks and to reference events for the record. In the past, Local Controllers also recorded departure time on flight strips. Controllers tend to obtain time from the data block on the ARTS BRITE rather than using the console clocks, except for the mid-shift when ARTS is down. Clocks in the Local Controllers consoles are readable but the Flight Data's clock is mounted too high to be seen from the seated position. Times indicated by the cab console clocks do not appear reliable either. On two separate observations, these times differed by as much as five minutes among the 5 clocks.

Ground Controllers use time information in monitoring traffic flow but have no clocks at their own positions.

(2) Barometric Pressure, Altimeter (Figure 3-5, 3-6)

A. Characteristics

Digital display - Unit approximately 3.0" high by 3.0" wide.
Digits approximately 0.50" high by 0.25" wide.
Displays in inches and hundredths of inches of mercury.

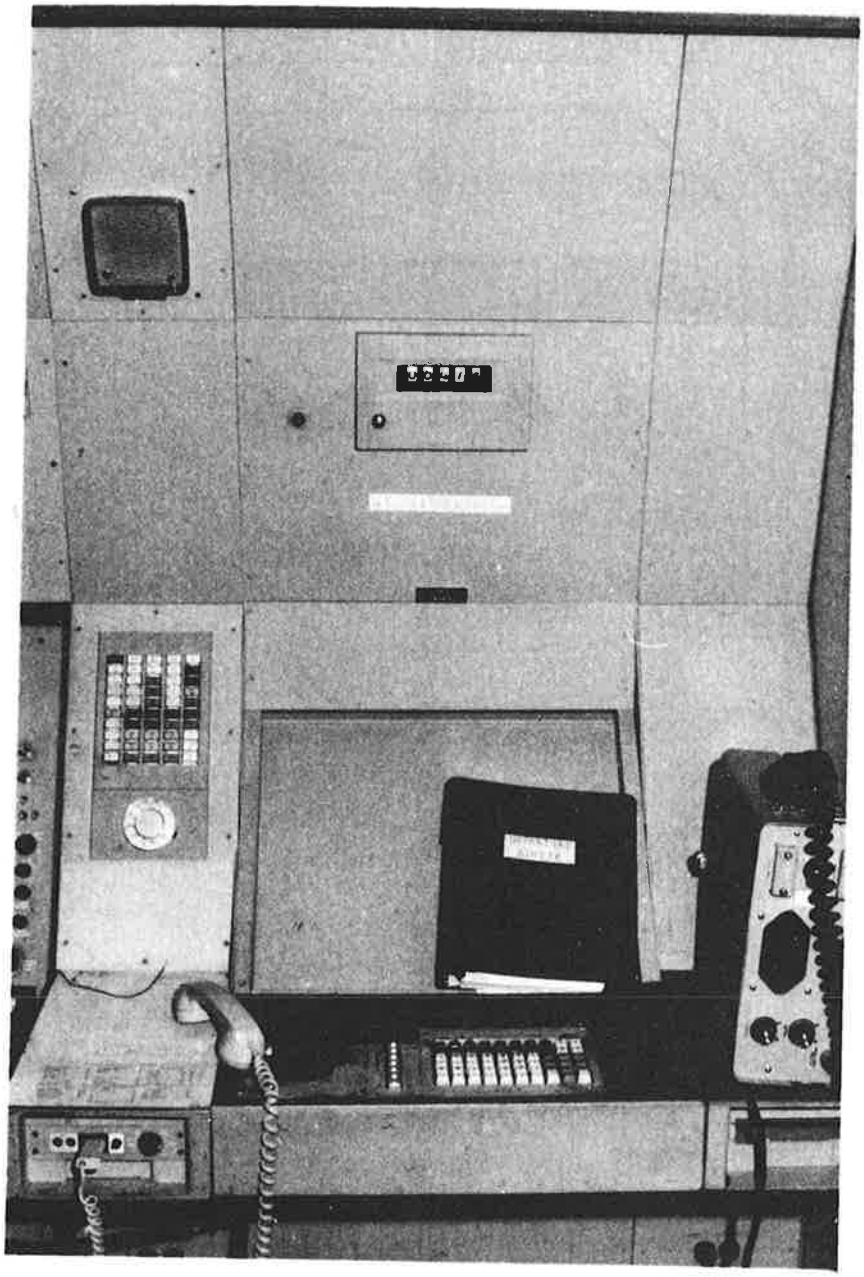


FIGURE 3-3. DH-1 POSITION SHOWING LOCATION OF CLOCK,WELL ABOVE LINE OF SIGHT OF SEATED CONTROLLER

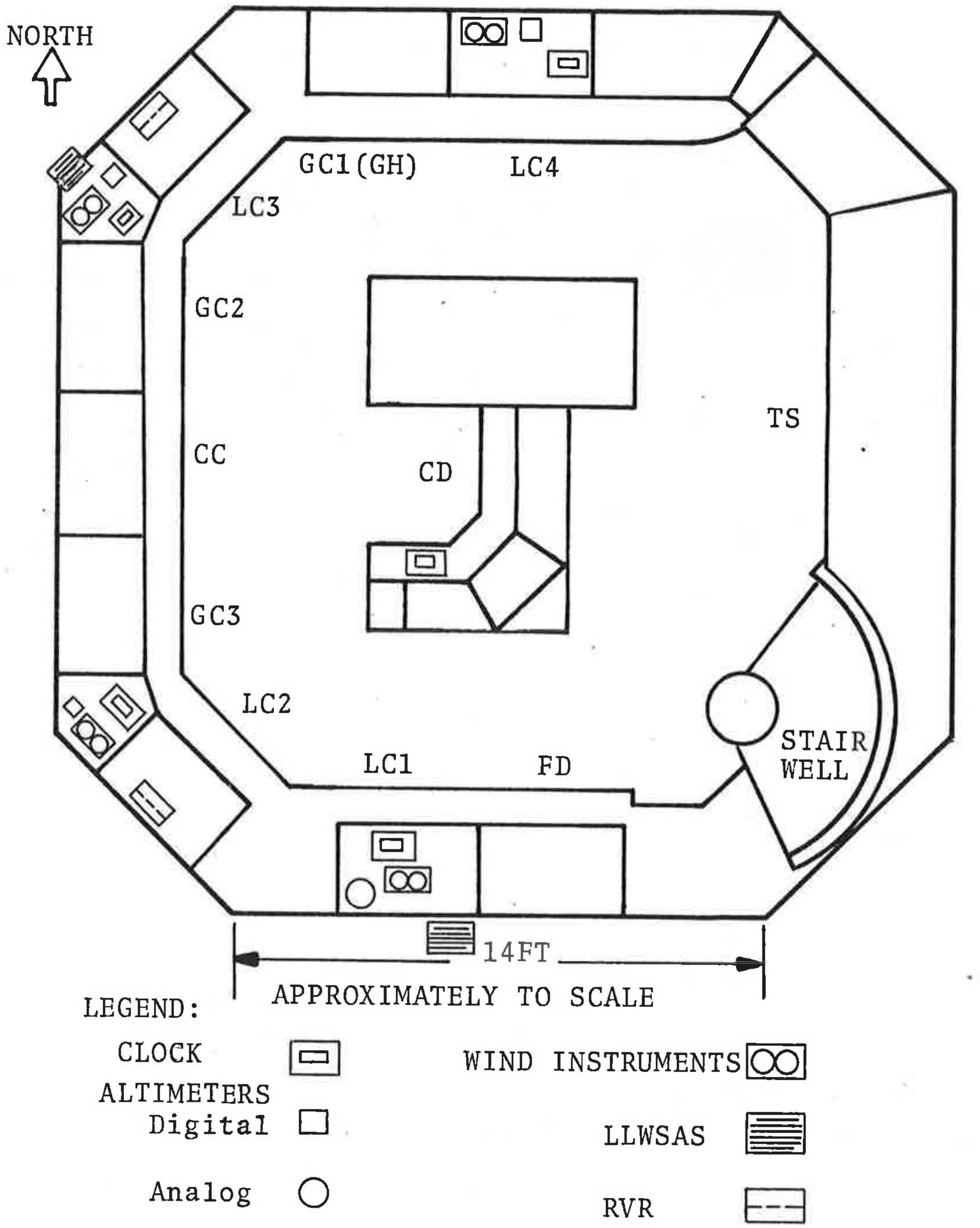


FIGURE 3-4. LOCATION OF WEATHER EQUIPMENT IN TOWER CAB

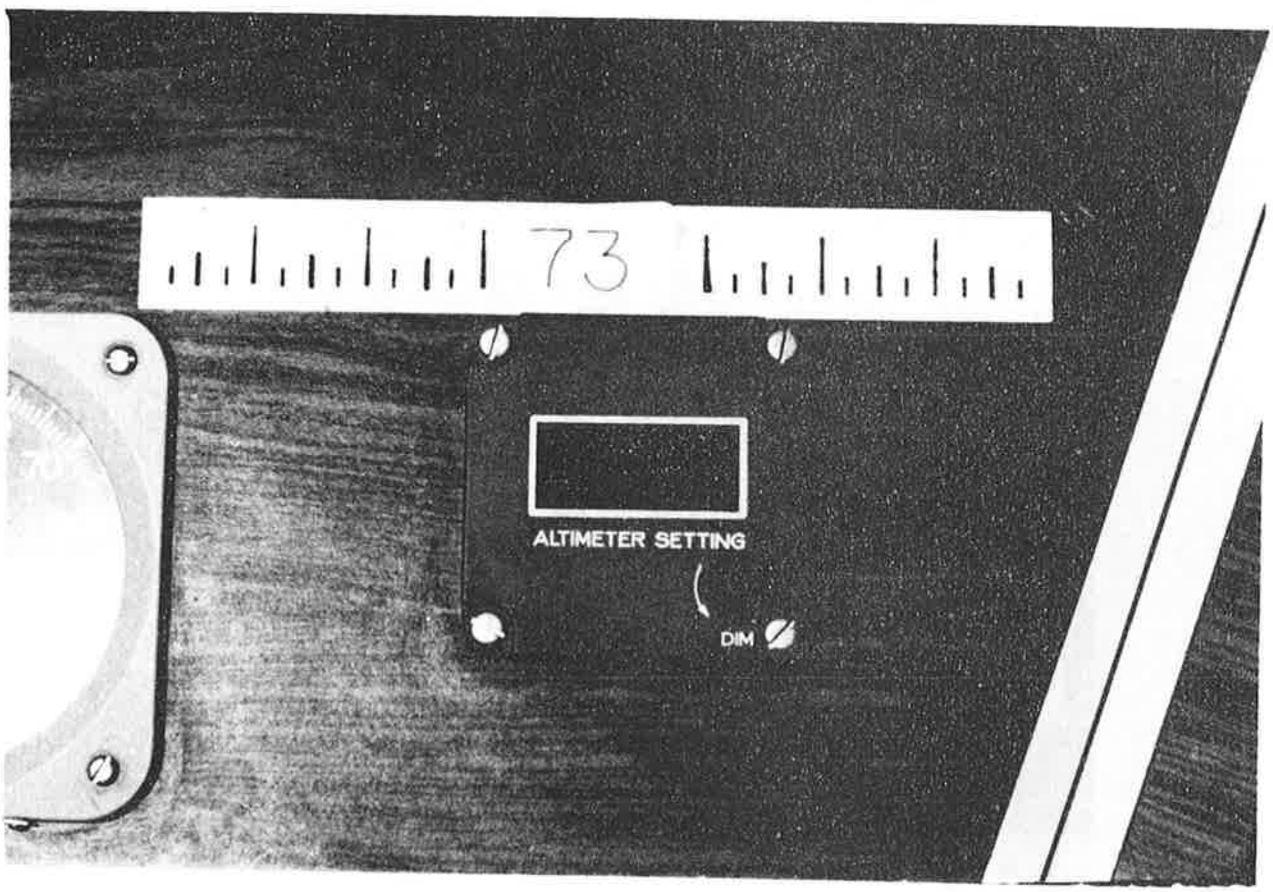


FIGURE 3-5. DIGITAL ALTIMETER USED IN CONTROLLER CONSOLES IN TRACON AND CAB

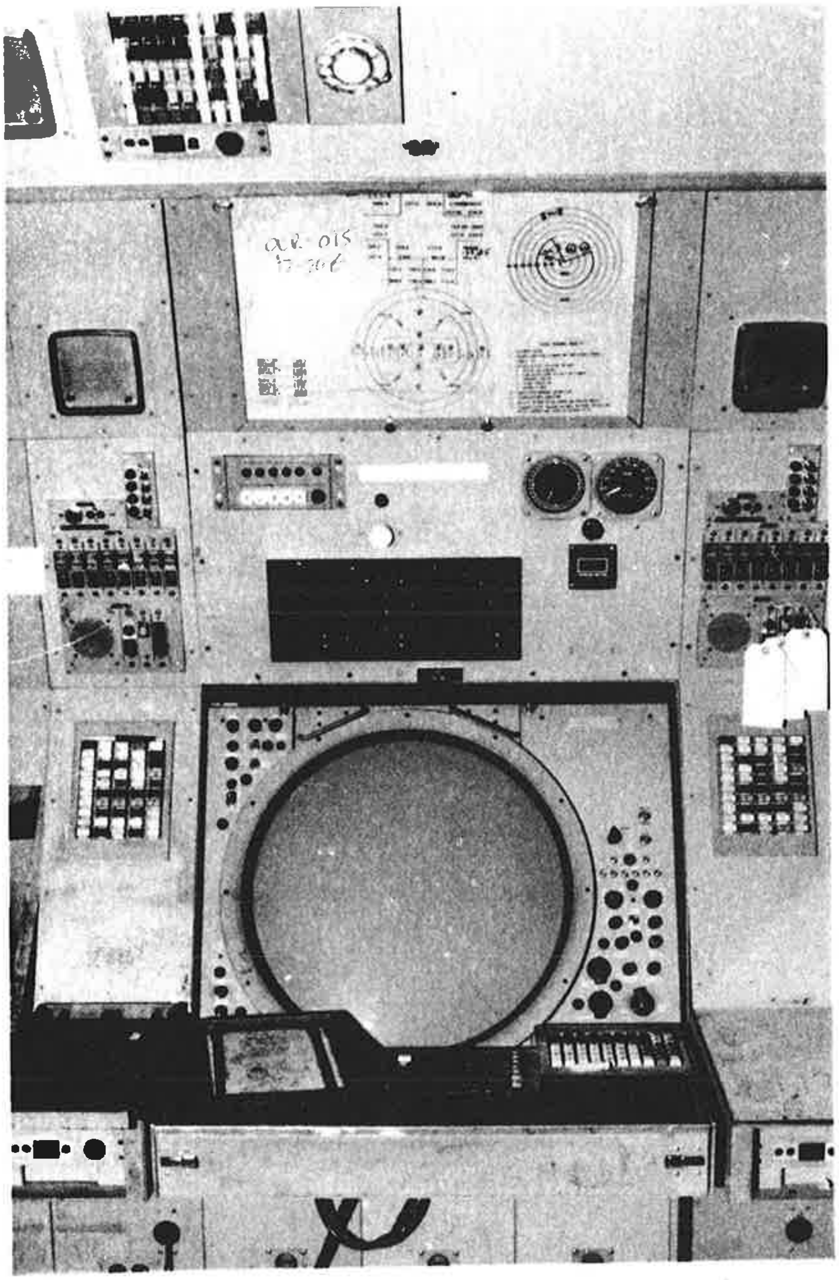


FIGURE 3-6. TERMINAL AREA RADAR POSITION SHOWING LOCATION OF WEATHER INSTRUMENTS

Uses 4 digits with decimal point after first two.

Analog display - (Figure 3-1).

Display case 8" in diameter.

Scale range - 28.00 to 31.00 reading in inches and hundredths.

B. Deployment in TRACON

Locations: (Figure 3-2)

TAR-1 (Terminal Area Radar)
TAR-2
AR-1 (Arrival Radar)
DR-4
DR-3
SAT-2 (Satellite Radar) analog display

Users - Normally not used in TRACON because pilots get altimeter reading from ATIS or from their companies. When pilots do request altimeter readings, most controllers usually give the value shown on the ARTS even though it may be an hour old, because it agrees with the ATIS report. However when weather is fluctuating, controllers prefer to give the realtime altimeter value from the console displays because of its timeliness. Console displays must also be used during the mid-shift when the ARTS is down for maintenance.

C. Deployment in Cab

Locations: (Figure 3-4)

LC-1 (Local Control
LC-2
LC-3
LC-4

Users - As in the TRACON, controllers prefer to use the altimeter readings shown on the BRITE because it agrees with the

ATIS message. However, when aircraft are at low altitude and in conditions of fluctuating pressure the console units are preferred. The controllers have the most trust in the analog display and use it as a standard against which to check the digital units for accuracy. A survey of the four altimeters located in the cab showed them to read within one-one hundredth of an inch of one another.

(3) Wind Direction and Speed (Analog indicators, Figure 3-1)

A. Characteristics

Dial diameters - approximately 3.7"
Instrument casing - 4.5" by 4.5"
Range of measurement - 0° - 360° 0 knots - 100 knots
Sensor location - Centerfield wind sensor located near end of runway 8 as shown in Figure 3-7.

B. Deployment in TRACON

Locations: (Figure 3-2, 3-6)

TAR-4 (Terminal Arrival Radar)	DR-1 (Departure Radar)
TAR-3	DR-2
TAR-2	DR-3
TAR-1	DR-4
AR-1 (Arrival Radar)	SAT-2 (Satellite Radar)
AR-2	

Users - Arrival Radar often issues wind, especially to light aircraft following heavy aircraft; Terminal Area Radar uses wind information primarily as an indicator of potential traffic control problems; and satellite controllers often give Atlanta wind conditions to pilots landing at satellite airports without their own wind information. Departure Radar never gives wind except during the mid-shift when all controller functions are combined at the DR-1 and DR-3 consoles.

C. Deployment in cab

Locations (Figure 3-4)

LC-1 (local Control)
LC-2 at adjacent console
LC-3 at adjacent console
LC-4

Users - Local Control gives winds to arrivals when giving clearance to land. Since winds are on ATIS, Ground Control only needs wind information as a backup in case of ATIS failures and occasional pilot requests. However, cab controllers are instructed to use the low level wind shear alert system (LLWSAS) rather than the conventional analog indicators although the analog displays are preferred for wind information in response to pilot requests for wind checks and when variations in gusting winds are important.

(4) Low Level Wind Shear Alert System (LLWSAS)

A. Characteristics (Figure 3-7)

The LLWSAS display is enclosed in a box measuring 9" high, 10" wide and approximately 7" deep. The display can present six rows of information and has a single column of push-push control buttons with one button before each row. The information presented in each row is derived from the centerfield wind (CW) and 5 boundary wind sensors (SE, NW, NE, SE, S) shown in Figure 3-8.

Centerfield Wind - Depression of the top button activates all the flat pack character displays on the console for a filament check. The top line of information beside that button is normally continuously activated and contains 7 characters representing centerfield wind; including 3 characters for direction, 2 characters for speed, and 2 characters for average wind gusts.

Boundary Wind - Depending upon the initial state, depression of the push-push button before each row of boundary information either places the row in a state of continuous display or in an automatic mode. In continuous display, 5 characters are shown continuously and include 3 characters for wind direction and 2 for wind speed. In the automatic mode when boundary winds vary from

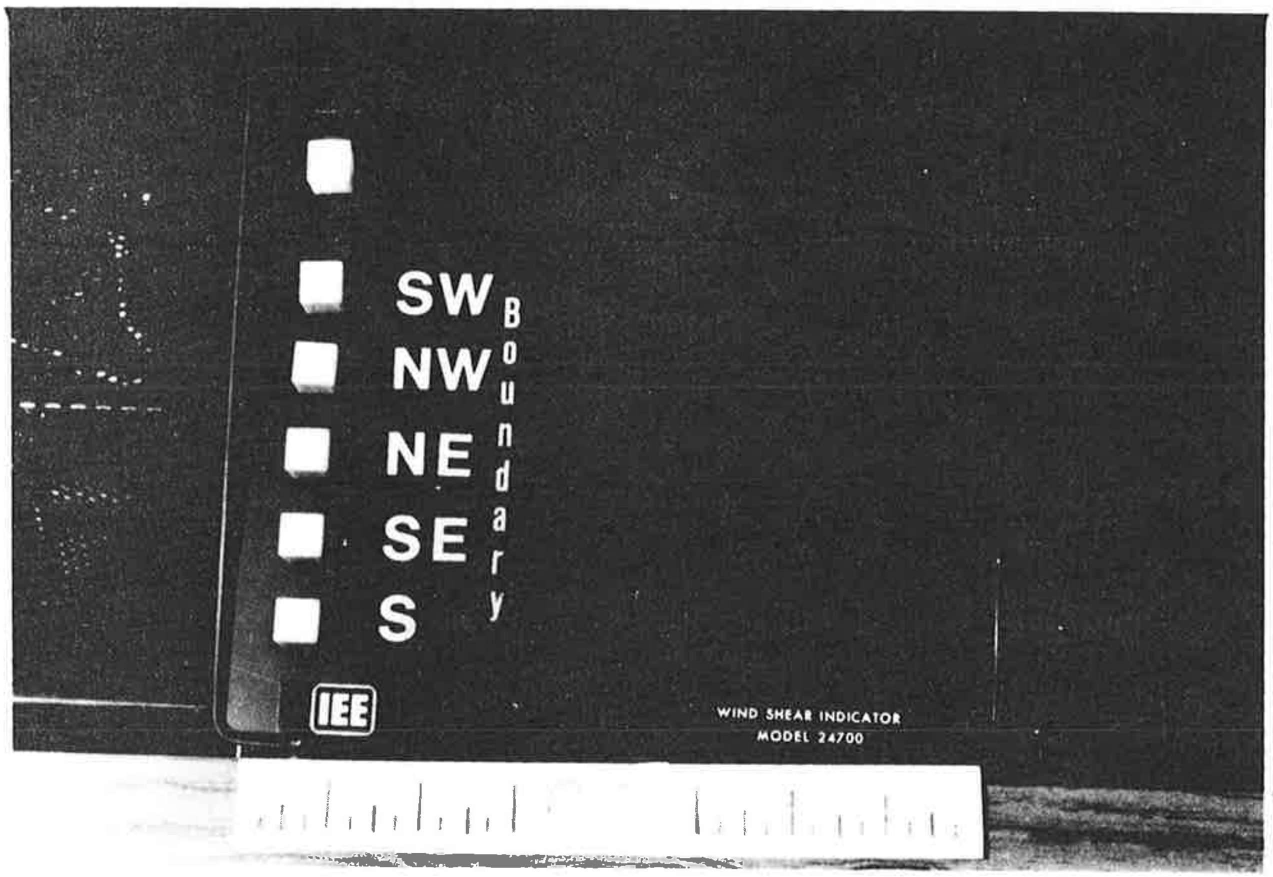


FIGURE 3-7. LLWSAS DISPLAY

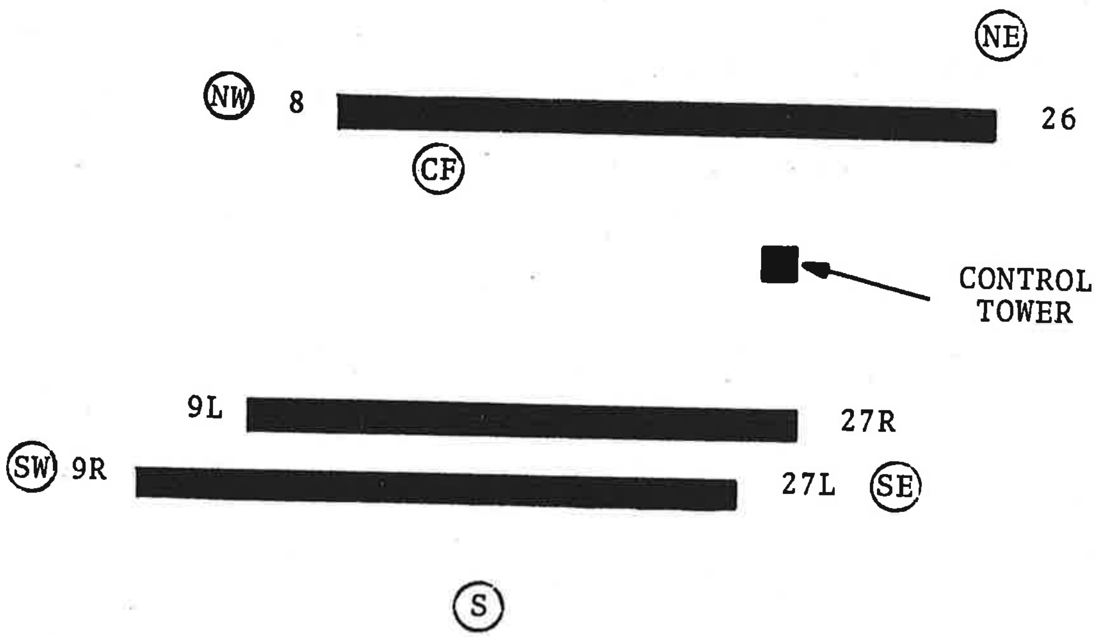


FIGURE 3-8. MAP OF HARTSFIELD-ATLANTA - RUNWAY SYSTEM SHOWING LOCATION OF BOUNDARY AND CENTERFIELD WIND SENSORS

the centerfield wind to a prespecified amount, the direction and speed of that wind is shown and an alarm is sounded for 1 second. The alarm may sound with wind differences as small as 5 knots. The alarm threshold is not adjustable.

B. Deployment in TRACON

No LLWSAS displays are located in the TRACON.

C. Deployment in cab

Locations (Figure 3-4)

LC-1 (Local Control)

LC-3

Users - Local controller gives centerfield wind when he gives landing clearances unless the wind is below 10 knots. Because of the high frequency of alarms, only alarms representing wind differences larger than 10 knots are issued to pilots.

(5) Runway Visual Range (RVR)

A. Description (Figure 3-9)

With the exception of the 2-unit RVR panel in the DR-3 console, the RVR panels are used in the TRACON and cab in a three unit configuration produced by adding a single unit display panel to a two-unit panel as shown in Figure 3-9. The double unit shown requires 6" x 7" of console space, and when combined with a third unit needs a 6" by 16" console area.

Each unit contains an eight-position selector switch, a triple window and alarm controls. The selector switch can select the value of any one of the 5 RVR sensors located in the field (Figure 3-10) for presentation in the three segment window below it. Because there are only 5 RVR sensors, 3 of the switch positions are inactive. Indicator lights show the 8 positions possible for the switch. When one position is selected, the light is activated showing which RVR sensor is providing the reading in the window below. The window indicates the RVR reading in hundreds of feet using 2 digits and it may show one of the following non-numeric characters in the third segment of the window.

FIGURE 3-9. DOUBLE SEGMENT OF TRIPLE UNIT RVR CONSOLE

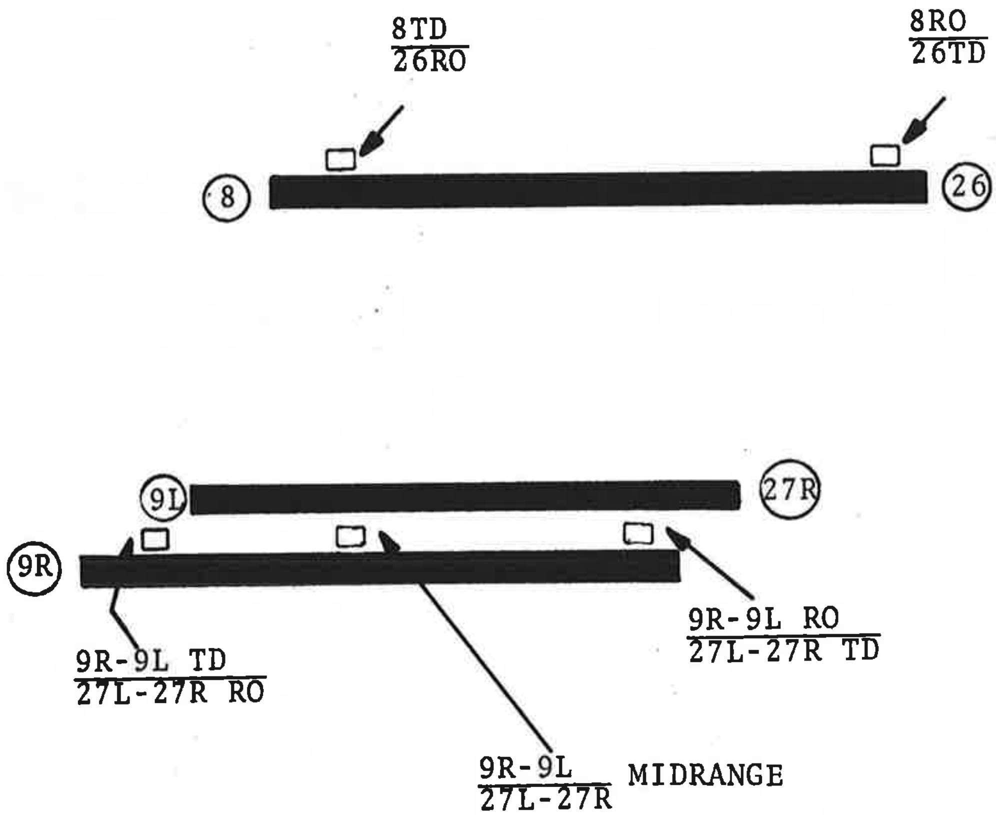


FIGURE 3-10. RUNWAY LOCATIONS OF THE 5 RVR FIELD UNITS OF HARTSFIELD-ATLANTA

L - Light level too low

\+ - Reading higher than indicated

\- - Reading less than indicated

T - In test mode

E - Error in the system.

The pair of dials beneath each window are used to select alarm thresholds. A yellow indicator light beside them and an auditory alarm are activated when RVR values equal or drop below these thresholds. The three-unit display is normally used to obtain RVR values on a single runway at a time. The left dial is used to select the sensor for touchdown RVR, the center dial for mid-range, and the right dial for rollout. RVR values for sensors not initially selected can be obtained instantaneously by moving the selection switches, but this is never done. When runway 8/26 is selected, the left window is used for touchdown RVR and the center one for rollout.

B. Deployment in TRACON

Locations

TAR-1 (Terminal Area Radar) not staffed
TAR-2
TAR-3
TAR-4 not staffed
AR-1 (Arrival Radar)
AR-2
DR-1 (Departure Radar)
DR-2 not staffed
DR-3

Users - During marginal visibility conditions, RVR panel is scanned by TAR and AR controllers on every operation so that pilots can be informed in case of significant departures from ATIS and to anticipate changes in metering and spacing requirements. DR-1 and DR-3 controllers require the same information during mid-shift when they handle arrival functions.

C. Deployment in cab

Locations

LC-2
LC-3

Users - During IFR conditions, Local Control advises arrivals and departures. Ground Control keeps taxiing departures apprised, particularly during marginal and fluctuating visibility conditions. Getting RVR information is awkward for Ground Controllers, none of whom have their own displays.

(6) ATIS

A. General Description (Figure 3-11)

Arrival and departure ATIS units are used in the cab for recording, reviewing, and disseminating weather messages and selected operational instructions to aircraft. Arrival messages are usually recorded hourly and include: code letter (A through M) altitude readback, runway holding information, weather, approaches in use, ILS approach information, and instruction to acknowledge ATIS code on initial contact with ATL tower. Departure messages include: code letter (N through Z), altitude readback, weather, departure runway in use, clearance instructions for IFR and VFR operations, instructions to acknowledge ATIS code to CD, and gate-hold instructions if relevant.

B. Deployment in TRACON

Locations: No ATIS consoles in TRACON but the arrival code is shown on all ARTS displays.

Users - TAR 2,3; DR-1,3; SAT-1,2,3 controllers need ATIS code to verify code acknowledgements made by arrivals on initial contact with the tower.

C. Deployment in cab

Locations: Recording panels are located in console next to LC-1. Arrival codes are displayed on all ARTS displays and CD's ASR monitor. Departure code is not displayed in the tower except on the electrowriter message serving as basis for ATIS weather updates.

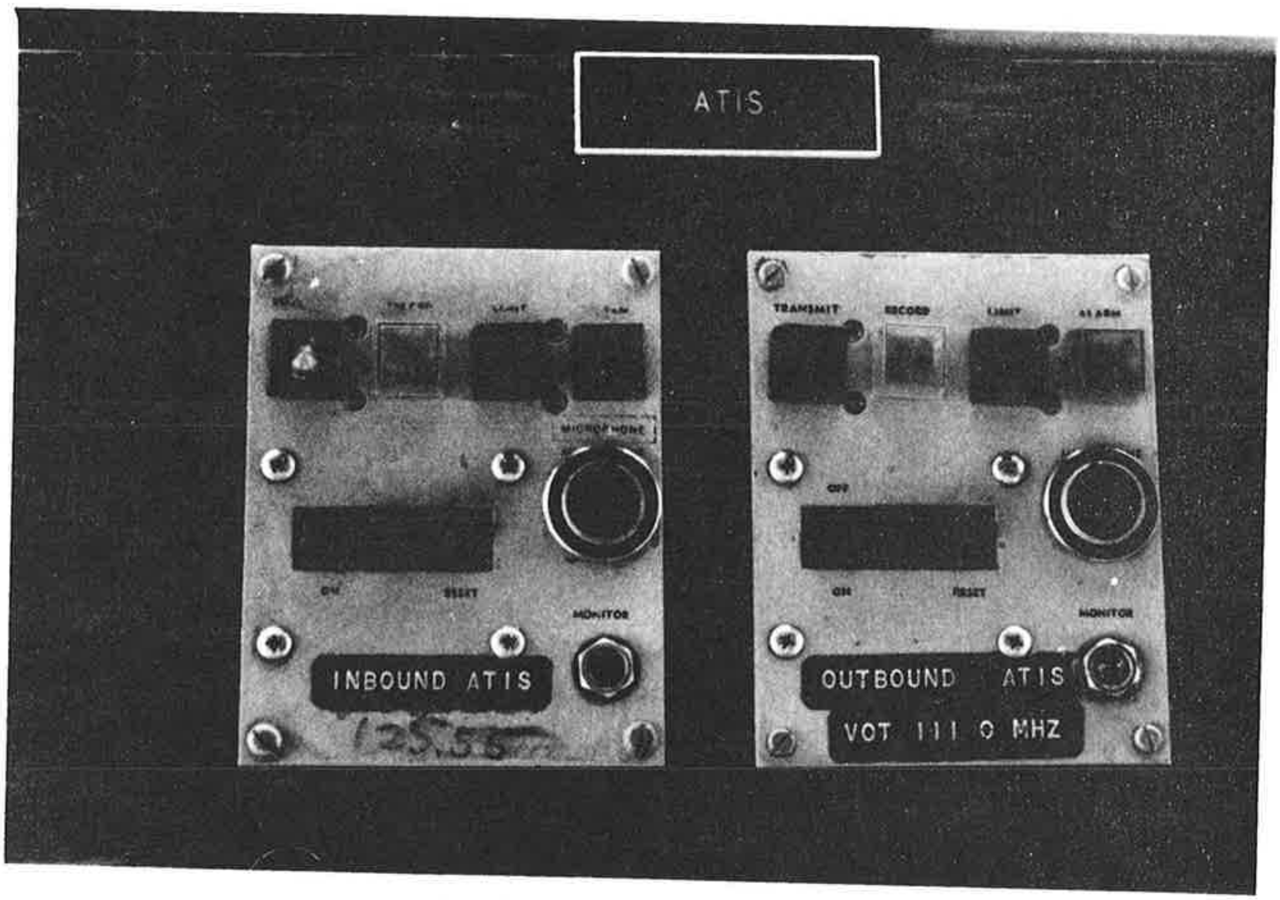


FIGURE 3-11. PANELS USED IN RECORDING INBOUND AND OUTBOUND ATIS MESSAGES FROM THE CAB

Users - CD and team supervisor and LC-1 share responsibility for recording ATIS messages. CD must have arrival code to enter on the ARTS displays and the departure code to verify code acknowledgements of departures.

3.2 CONTROL/STATUS PANELS

(1) ILS Monitor

A. Description (Figure 3-12)

16" x 15-1/2" panel located near the LC-4 console at position 38 (Figure 3-13). All except the bottom row of buttons are status indicators only. On the bottom row the three buttons with runway designations are depressed to activate the localizer and glide slope for the corresponding runways; the "silence" button is used to silence the alarm next to it; the "test" button illuminates all status buttons as a light check; the black knob adjusts the brightness of the status buttons; and the toggle switch is used to select the desired 26/8 runway orientation.

Any changes in equipment status, including that resulting from maintenance work on the system, triggers the auditory alarm. The resulting high number of false alarms is a constant source of irritation to the controllers and has destroyed the usefulness of the alarm feature as an alert to real malfunctions. Warning lights indicate which equipment is malfunctioning so that arriving pilots can be alerted and assess the effects on their landing minimums. However, these lights are difficult to detect in daylight brightness conditions and so may go unnoticed for some time, if the alarm is silenced without a close survey of the status lights. Team supervisors respond to valid alarms by notifying the assistant chief who calls AF.

B. Deployment in TRACON

There is no ILS panel in the TRACON.

C. Deployment in the cab

The team supervisor is responsible for turning the system on and off and changing runway orientations. As a matter of convenience LC-1 or LC-3 may also do this.

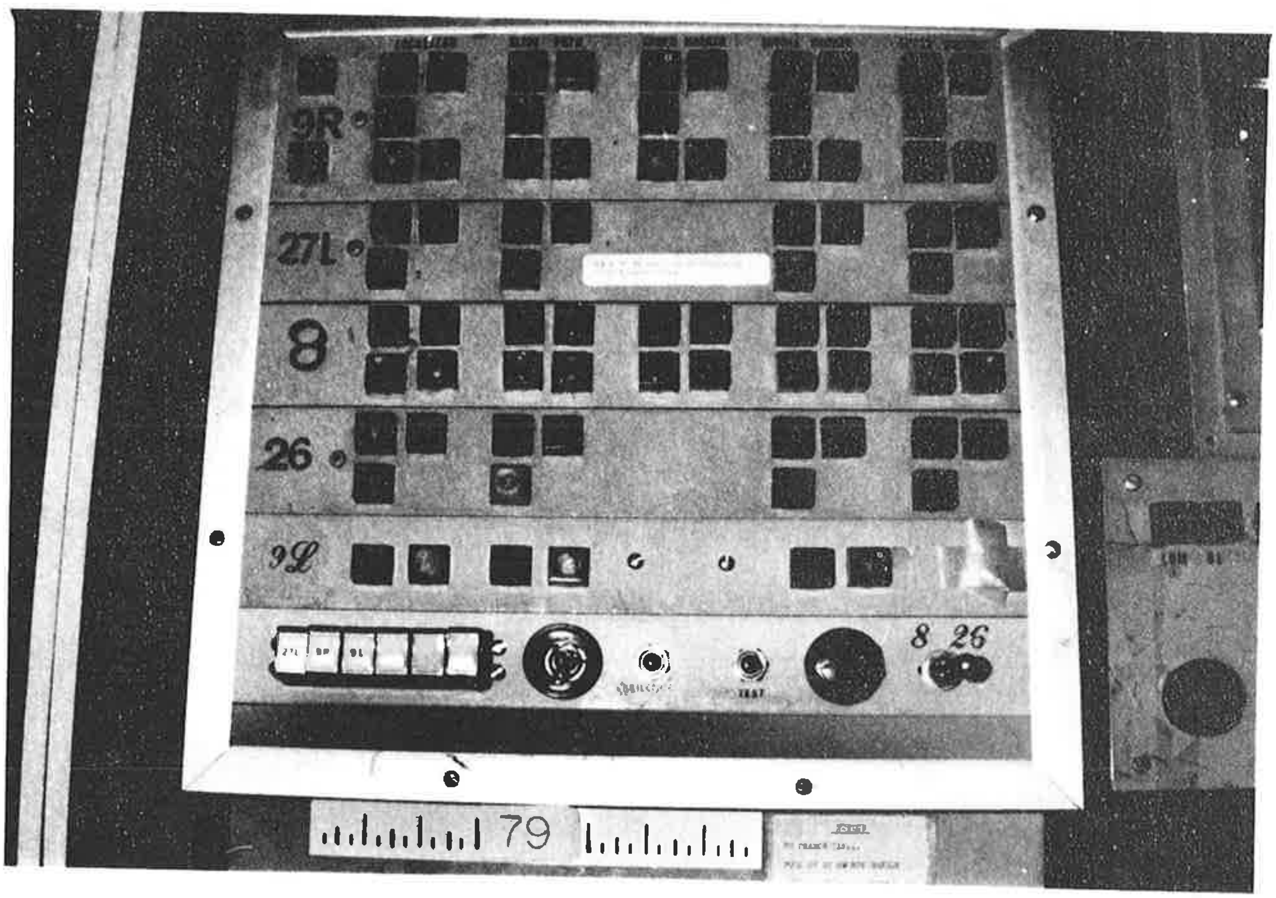
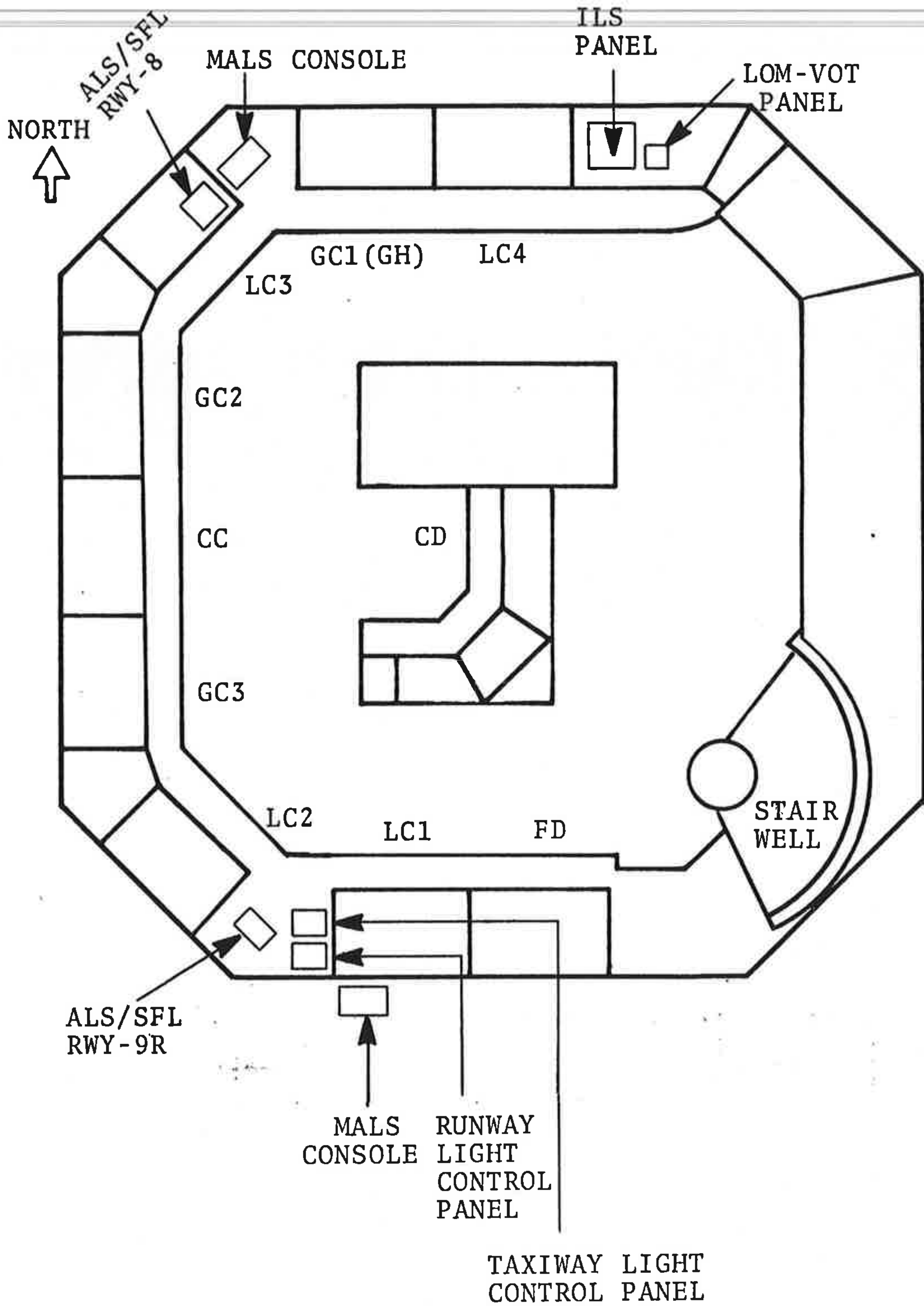


FIGURE 3-12. ILS PANEL LOCATED IN CAB



APPROXIMATELY TO SCALE

FIGURE 3-13. LOCATION OF STATUS AND CONTROL PANELS IN TOWER CAB

(2) LOM-VOT Panel (Figure 3-14)

8-1/2" x 5-3/4" panel located to the right of the ILS panel at Position 38. It provides on/off status information on the NDB (RED OAK) at the outer marker of runway 9L, on the LOM (CATTA) at the outer marker of runway 8, and on the VOR test facility (VOT). LOM REDAN off runway 26 is monitored by the flight service station personnel who use it to broadcast weather information. The VOT is used by the cab to broadcast the departure ATIS messages.

The LOM-VOT panel includes status indicators and an auditory alarm. The row of red and green pairs of indicators show the state of the equipment monitored. The buzzer is activated by changes in the status of that equipment. The sound of the auditory alarms on the ILS and LOM-VOT panels are indistinguishable. So when either is activated, both panels may have to be examined to determine the source of the alarm. The "silence" button silences the alarm; the "test" button is used to check the indicator light filaments and the alarm; and the "dimmer" is used to adjust the brightness of the indicator lights.

There is no LOM-VOT panel in the TRACON.

(3) Approach Lighting System/Sequence Flasher Lights

A. Description

The ALS/SFL panels (Figure 3-15) in the cab are used to control the ALSF-1 system (Figure 16) on runway 8 and the ALSF-2 system (Figure 3-17) on runway 9. Each panel requires approximately 10-3/4" x 9" of controller console space.

To activate the system the "brightness control" (central rotary switch) of the appropriate panel is turned to step 1 and "approach lights" switch is moved to the right to "on." The red lights and the buzzer are then activated. Moving the "ALS Trouble Switch" to the right silences the buzzer. After 3- seconds, the field lights warm up extinguishing the red light and reactivating the buzzer. The trouble switch is then returned to the left, silencing the buzzer. The brightness is then adjusted to suit visibility levels. When adjusted to step 5 - the brightest level -

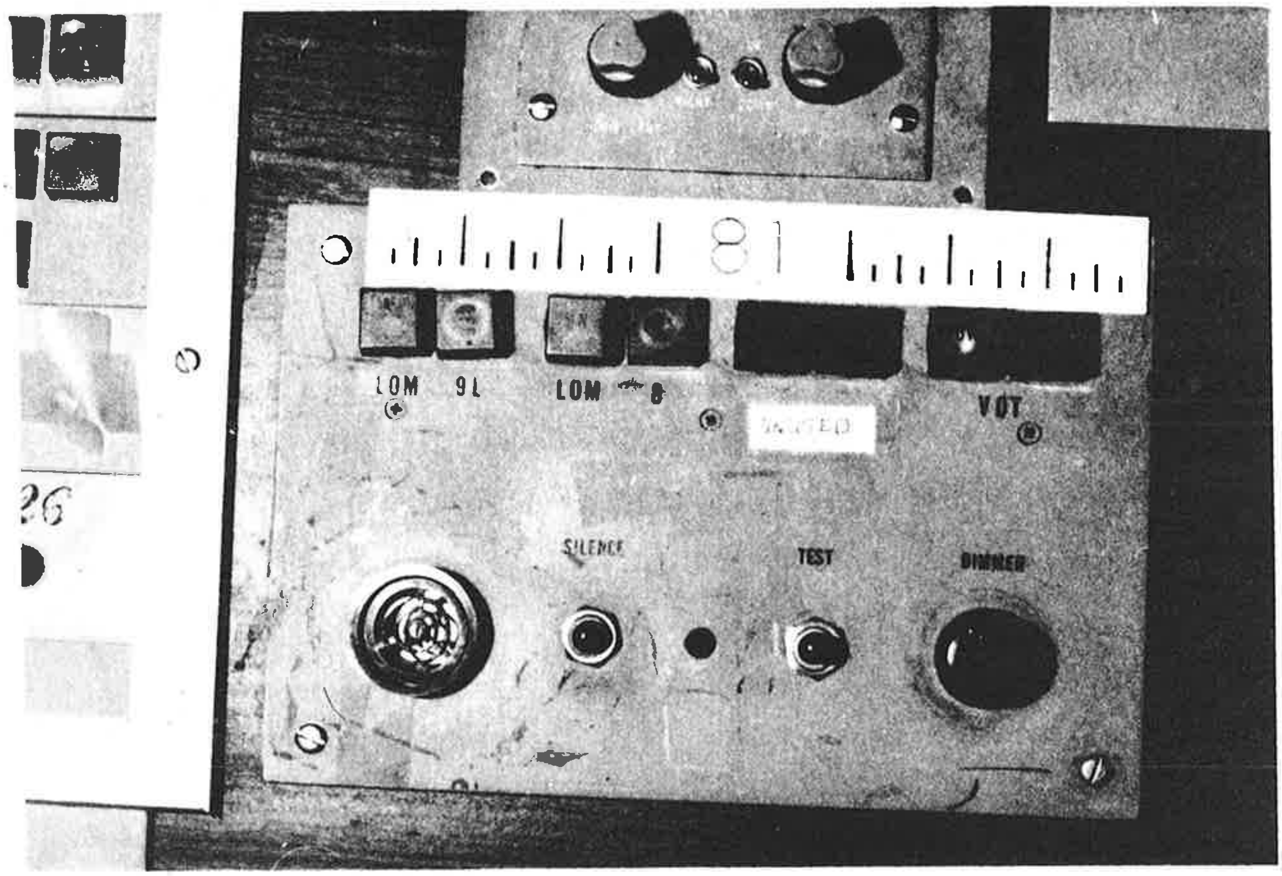


FIGURE 3-14. LOM-VOT STATUS PANEL

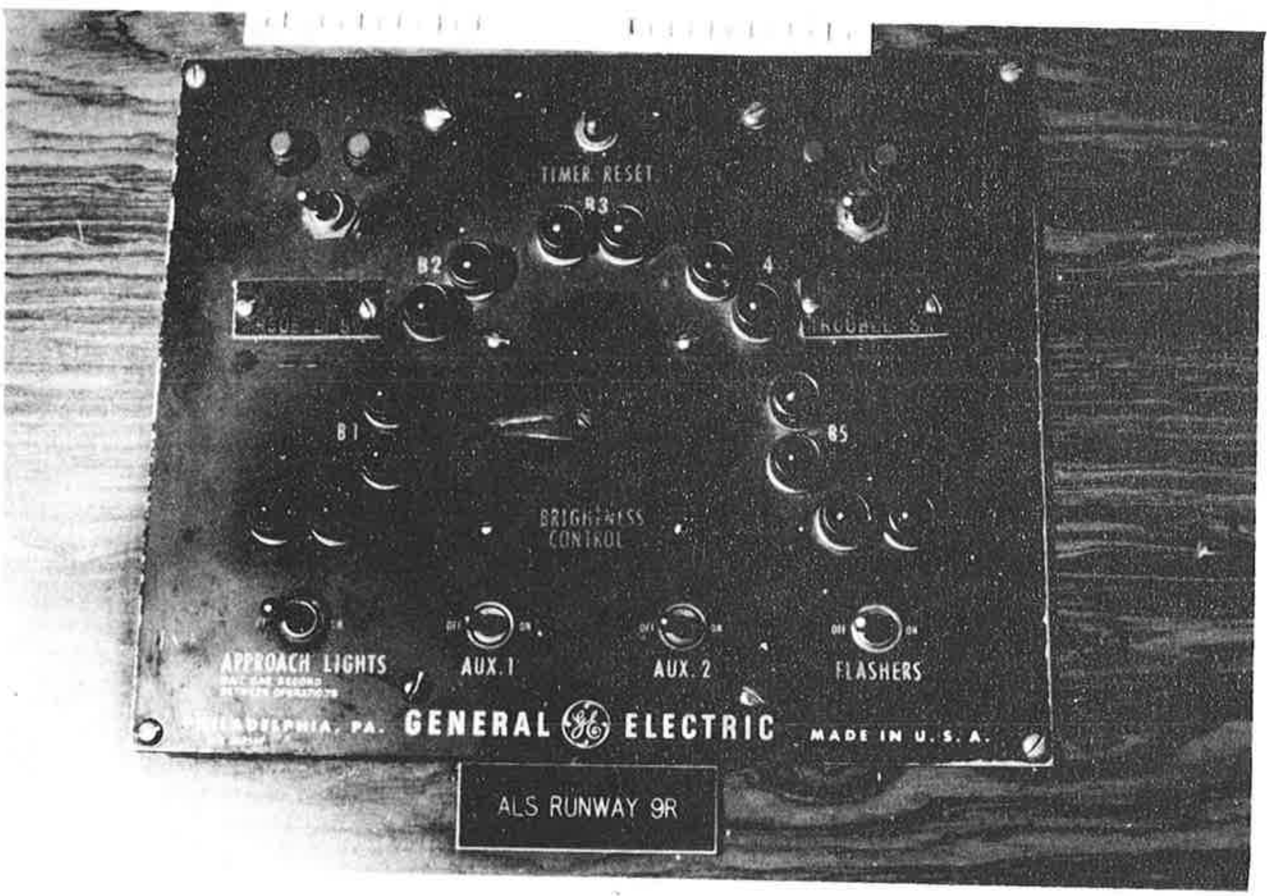
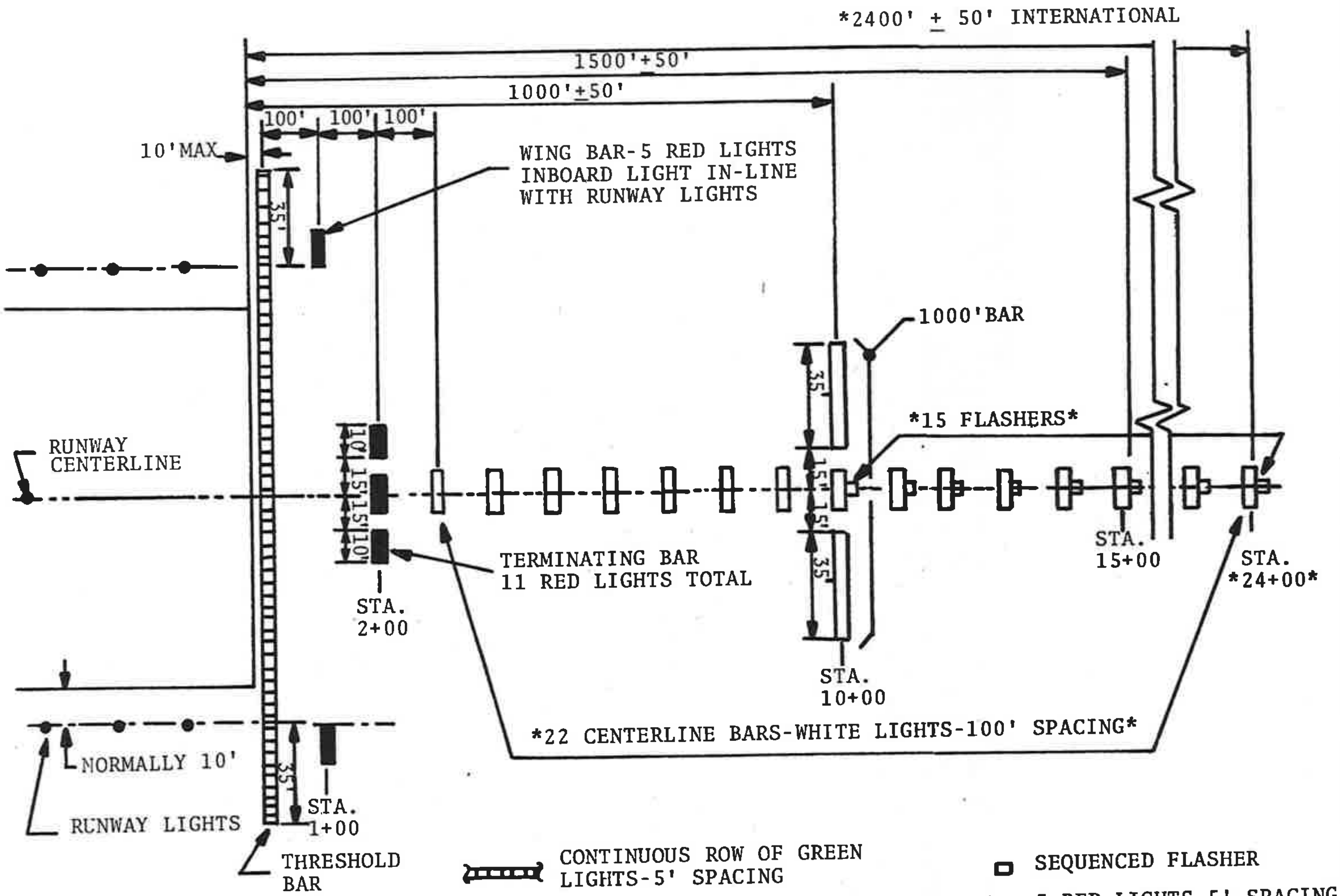


FIGURE 3-15. ALS/SFL CONTROL PANEL FOR 9R



*NOTE:

1. SYSTEMS INSTALLED AT INTERNATIONAL AIRPORTS WILL BE 3000ft. IN LENGTH, PARAGRAPH 20

FIGURE 3-16. ALS/SFL (ALSF-1 CONFIGURATION) LOCATED AT RUNWAY 8

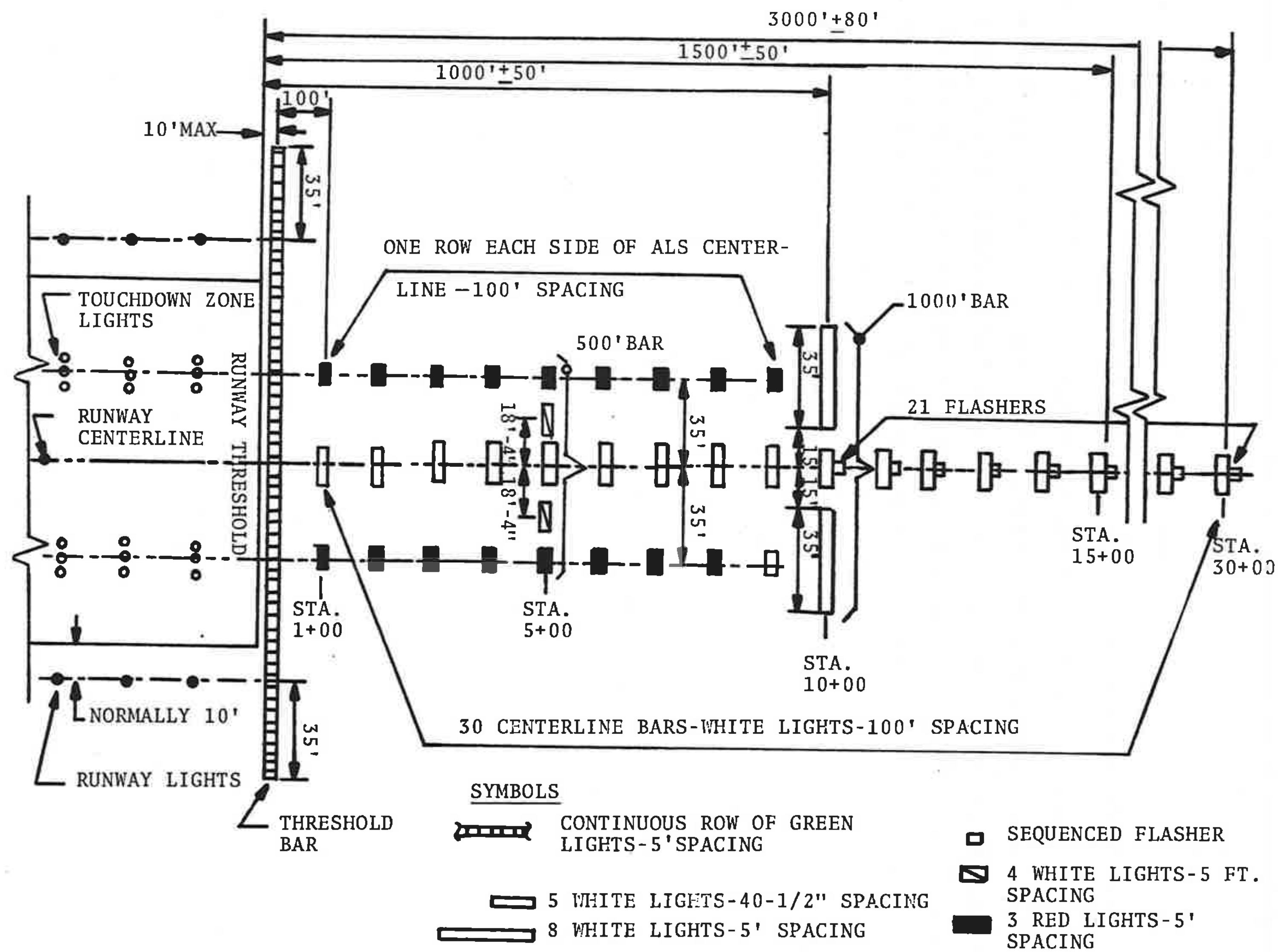


FIGURE 3-17. ALS/SFL (ALSF-2 CONFIGURATION) LOCATED AT RUNWAY 9R

the lights will automatically return to step 4 after 15 minutes. Pushing the "timer reset" or moving the "brightness control" from B5 to B4 and back to B5 will start a new 15-minute cycle. If 5 or more lamps go out, the pair of green lights above the "approach lights" switch go out and the pair of red lights at the upper left of the panel and the buzzer goes on. The buzzer is silenced by moving the "ALS trouble switch" to the right.

The flashers are turned on by pushing the "flashers" switch to "on." This causes the two small red lights at the upper right of the panel to go on momentarily. Then the larger green lights just above the "flasher" switch go on. A buzzer is sounded if three of the flasher lights in the field go out. The buzzer is silenced by moving the "SFL Trouble Switch" to the right.

B. Deployment in TRACON

There is no ALS/SFL panel in the TRACON.

C. Deployment in the cab

The ALS/SFL panels are located between LC-1 and LC-2 consoles (Figure 3-13) and are monitored and the controls are adjusted by the local controllers responsible for runways 9R and 8 (LC-2, LC-3). The majority of the time when pilots break through an overcast sky to clear visibility conditions, they request the flashers to be turned down or off. This requires quick access to the controls, but the location of the controls for runway 8 make quick responses unlikely.

The controllers do like the action of the brightness control switch. Its size and the positive clicks made by the switch as it is moved from one brightness level to the next make it easy to use even while not looking at it.

(4) Runway Light Control Panel

A. Description:

This panel (Figure 3-18) occupies 17-1/2 by 15-1/2 inches of console area and is used to turn on and adjust the brightness of runway edge and centerline lights, touchdown zone lights and lights on selected taxiways. The system contains no alarms. The indica-

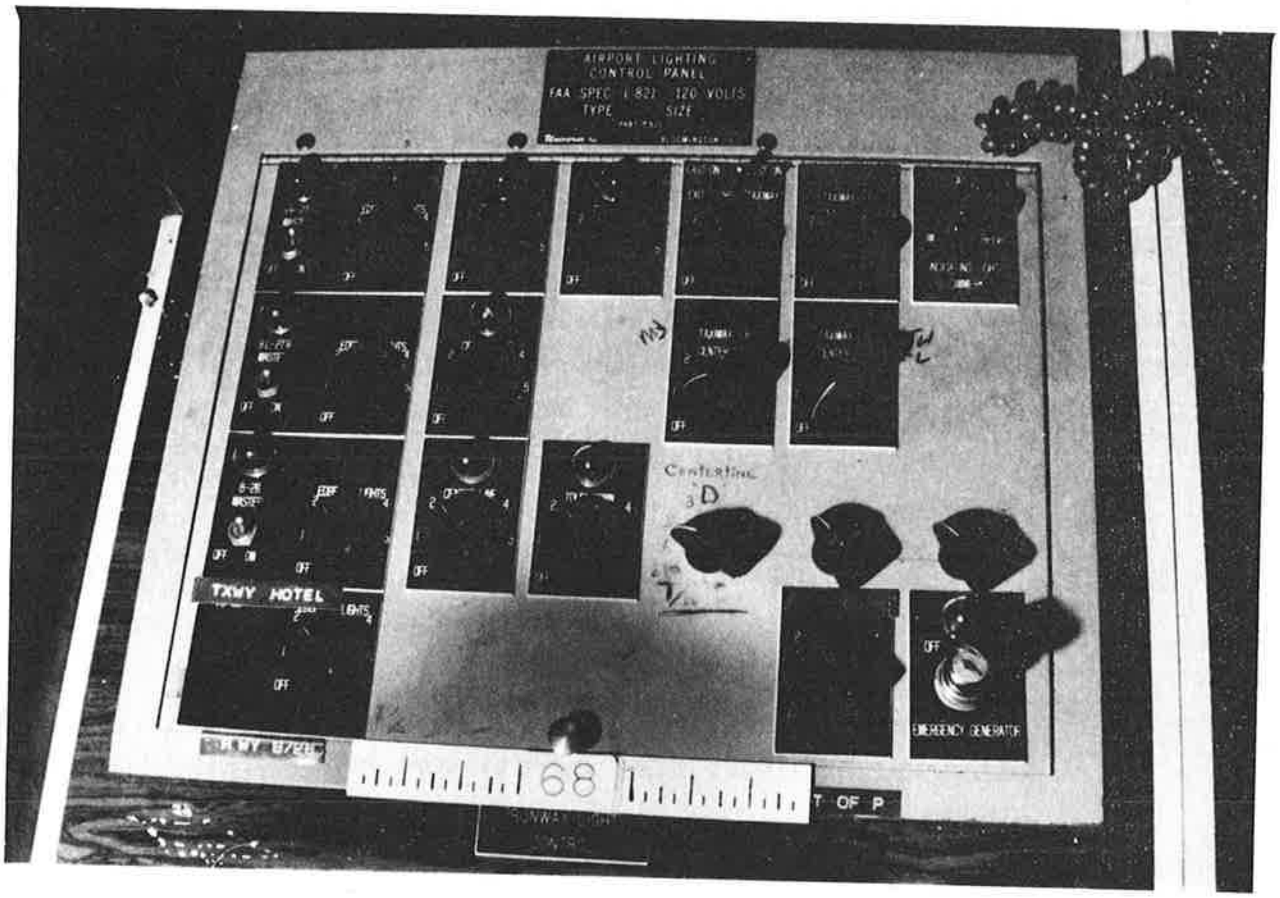


FIGURE 3-18. RUNWAY LIGHT CONTROL PANEL

tor lights at each switch show the status of the switch and not the condition of the field lights. Controllers depend upon pilot reports and their own visual sightings for detecting system malfunctions. The panel and field units that it controls are owned and maintained by the city.

The panel controls are as follows:

Row 1 - 9R/27 master switch
Edge lights, on-off and brightness
Centerline, on-off ard brightness
Touchdown zone lights, on-off and brightness
East-West Taxiway Selector, on-off and brightness
Taxiway E Centerline, on-off brightness
Indicating Light Dimmer, brightness of indicator lights in top row.

Row 2 - 9L/27R master switch
Edge lights, on-off and brightness
Centerline, on-off and brightness
Taxiway F Centerline, on-off and brightness
Taxiway L Centerline, on-off and brightness

Row 3 - 8/26 master switch
Edge lights, on-off and brightness
Centerline on-off and brightness
Touchdown zone lights, on-off and brightness
Taxiway D Centerline, on-off and brightness
Unknown
Unknown

Row 4 - Taxiway H, on-off and brightness
Unknown
Emergency Generator for field lighting

B. Deployment in Cab

Located between LC-1 and LC-2 positions (Figure 3-13). Local Control-2 usually makes all adjustments of the panel controls. The runway lights are turned on at sunset and the brightness is set to suit the visibility conditions. The brightness is rarely set at the lower levels, because when low, the lights

~~cannot be seen from the tower and so cannot be verified as on.~~ They are often set at the highest brightness level. This provides the highest RVR readings during low visibility conditions.

Each runway is controlled independently. Runways not in use are usually turned off, and controllers can respond to individual pilot requests for changes in brightness. Pilots breaking out from an overcast sky sometimes ask that the brightness be reduced, and occasionally controllers will indicate the active runway to GA pilots unfamiliar with the airport by changing the brightness levels of the runway lights. The East-West Taxiway selector controls the lighting of the high speed taxiways from 9R/27L and activates the lights of either the eastern or western exits depending upon whether 9R or 27L, respectively, is being used for arrivals. The supervisor uses the "Emergency Generator" switch in case of current failure.

Because of pilot requests, all local controllers need ready access to the control panel. In its present location LC-3 does not have such access.

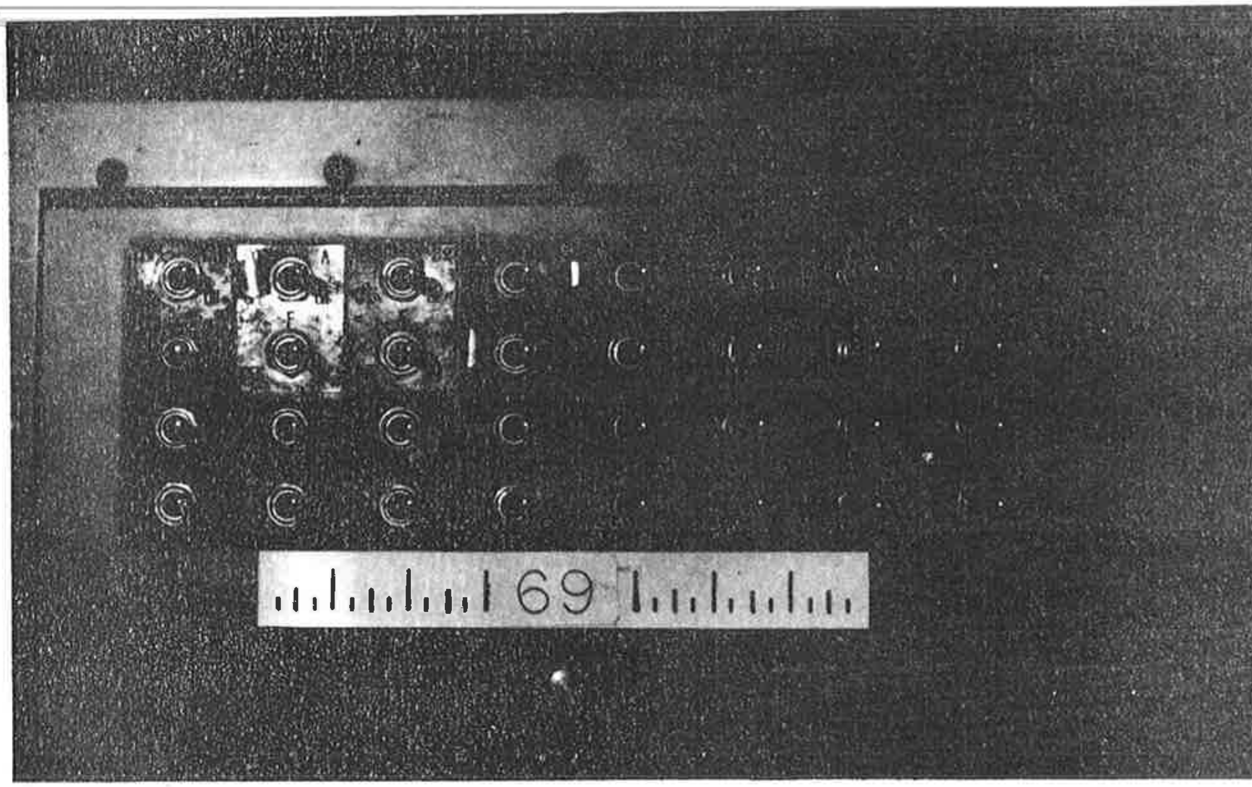
C. Deployment in TRACON

There is no airport lighting panel in the TRACON.

(5) Taxiway light control panel

A. Description

This panel (Figure 3-19) is located beside the Runway Light Control Panel between the LC-1 and LC-2 consoles and occupies approximately a 9" x 16" area of console space. The panel is used to turn on and off taxiway edge lights, taxiway signs, runway hold signs, and the beacon light at the top of the control tower. There is no alarm associated with the system to indicate malfunctions. Light failures are detected through pilot report and visual inspection. A key indicating the sections of taxiway controlled by each switch is mounted next to the control panel. Controls for taxiway D, E, F, and L centerlines and for taxiway hold are on the Runway Light Control Panel (Figure 3-18). The taxiway designations may be compared to the runway map shown in Figure 3-20. This map



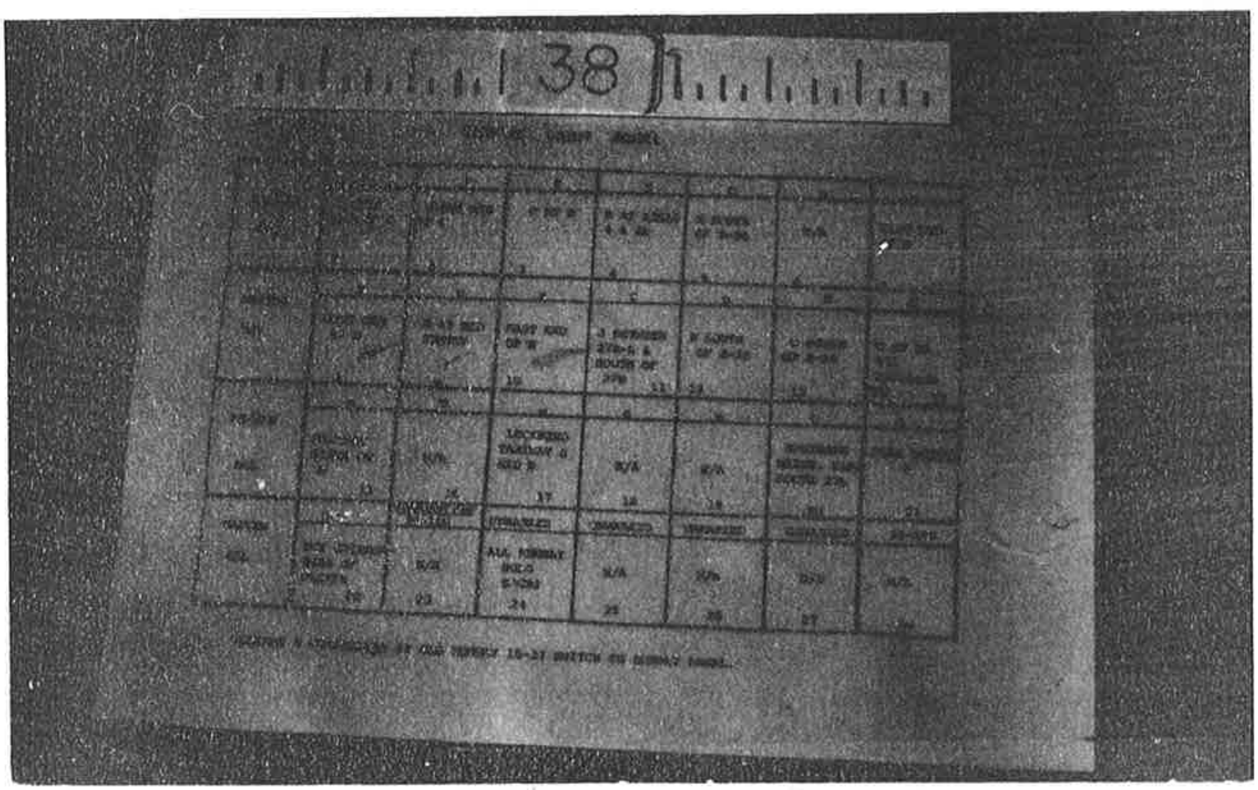


FIGURE 3-19. TAXIWAY LIGHT CONTROL PANEL AND KEY

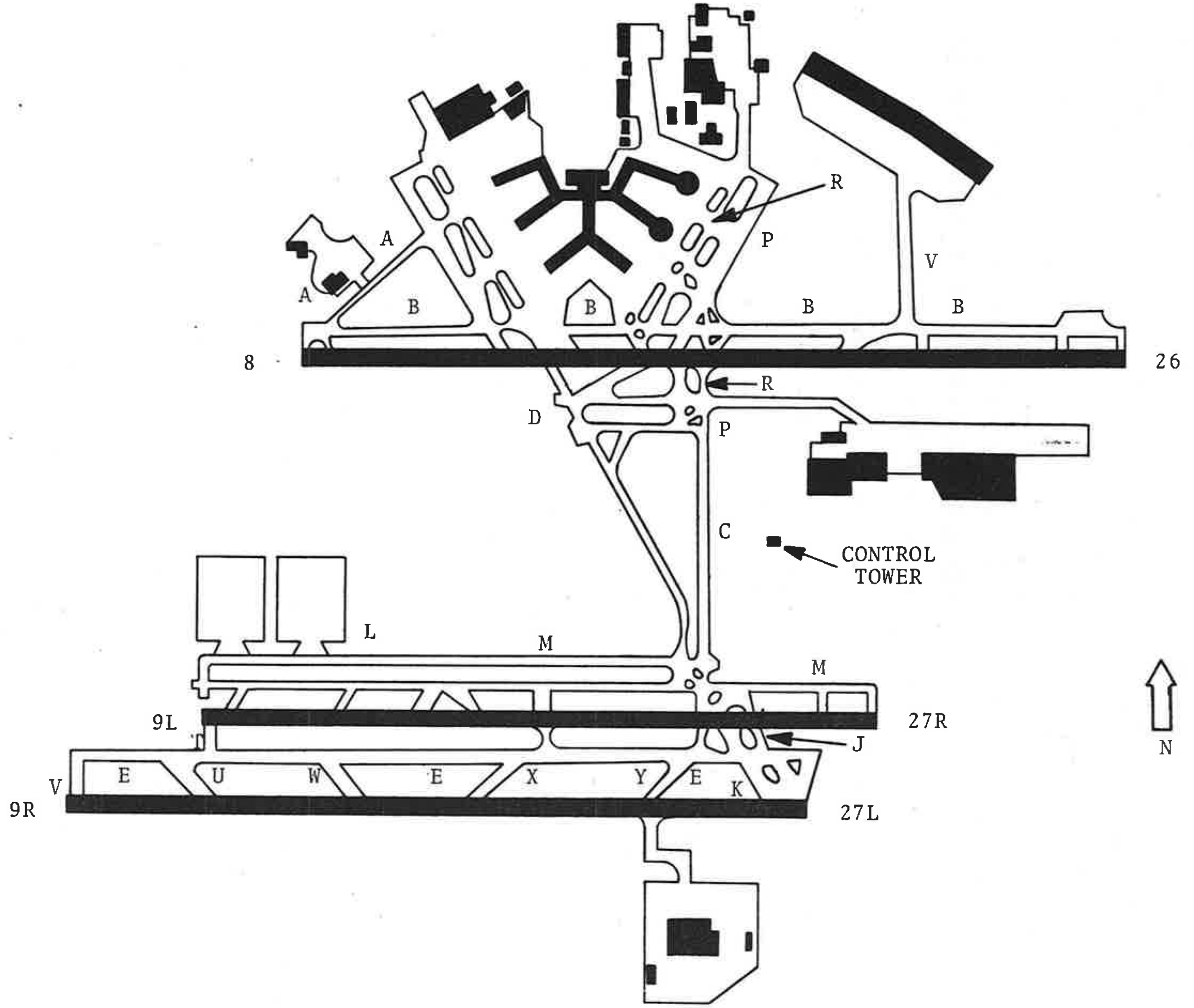


FIGURE 3-20. RUNWAY AND TAXIWAY CONFIGURATION OF HARTSFIELD-ATLANTA AIRPORT - 1978

was in effect during the data collection phase of the present study. At this writing it has been updated (Figure 3-21) to reflect changes in the configurations and designations on taxiways located between runways 8/26 and 9L/27R.

Functions of switches not specifically concerned with taxiway segments are:

Master Switch -	Controls power to all switches in the row. Normally it is left on and the segments of taxiway are turned on and off one at a time.
Taxiway Signs On -	Controls all taxiway signs
BCN -	Controls rotating beacon on terminal building. It is wired to "on" position and operates regardless of the position of master switch in that row.
Centerline 30-100 -	Two-position switches which select brightness of centerline as 30 or 100 percent of full brightness.
Runway Hold Signs -	Activates all runway "HOLD" signs on the airport.

B. Deployment in TRACON

There is no Taxiway Light Control panel in the TRACON.

C. Deployment in cab

Local Control-2 operates the panel, probably because he is the controller closest to it. The location of the panel probably is not important because it is only used at sunrise and sunset or when there is a change in the configuration of active runways.

(6) Medium Intensity Approach Lighting System (MALS)

A. Description (Figure 3-22)

The MALS control consoles are approximately 6-3/4" high, 13" long, and 6=1/2" wide and are located at Local Control 1 and 3 positions. They are not an integral part of the controllers

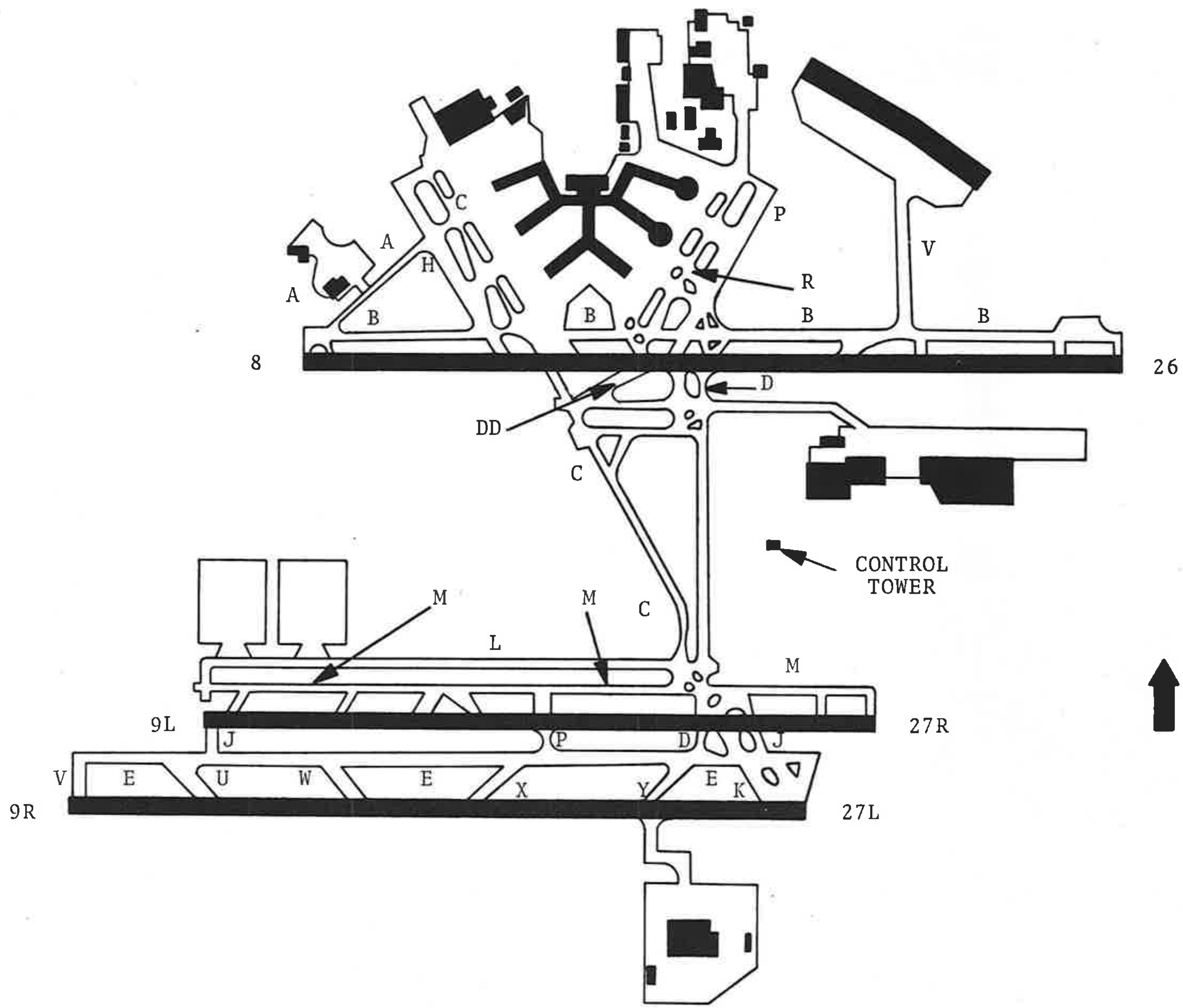


FIGURE 3-21. RUNWAY AND TAXIWAY CONFIGURATION OF HARTSFIELD-ATLANTA AIRPORT - 1979

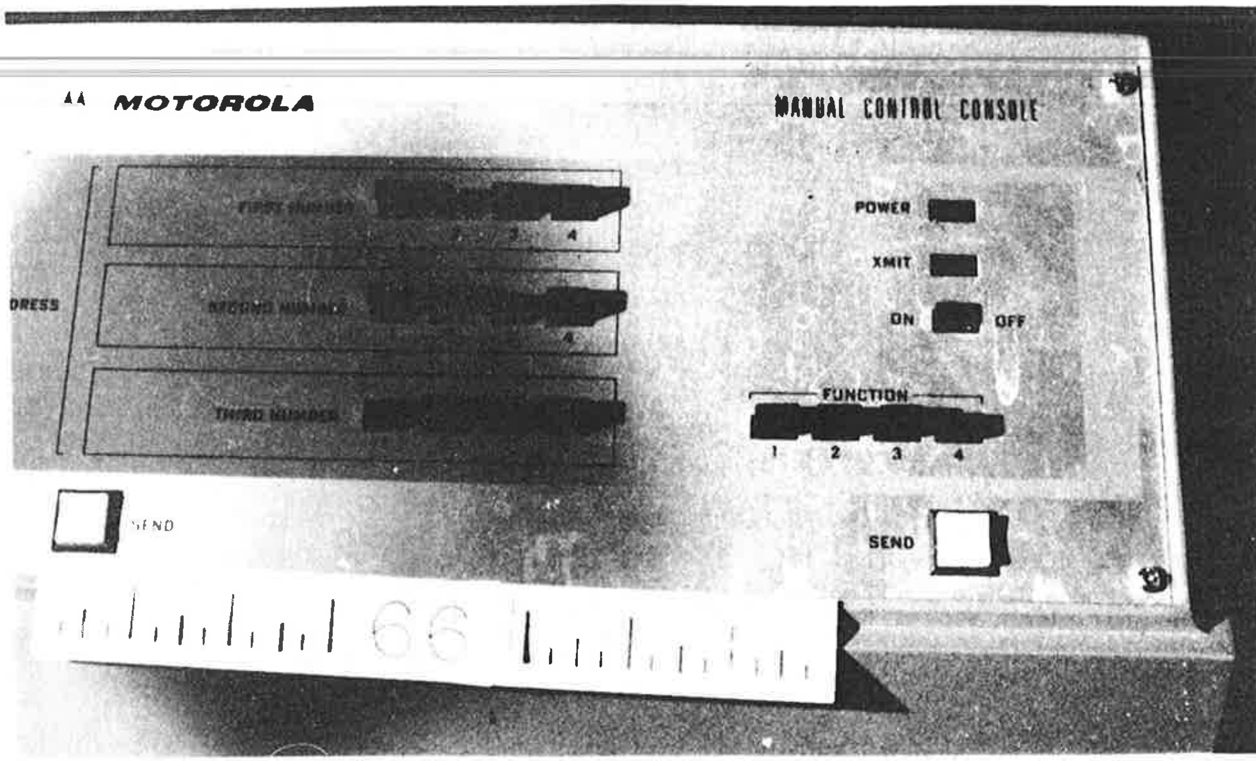


FIGURE 3-22. MALS CONTROL CONSOLE

FIGURE 3-23. CODE USED FOR ADJUSTING BRIGHTNESS OF MALS AT 27L WITH MALS CONTROL CONSOLE

consoles and so can be moved. The consoles are used to turn the MALS on or off and to adjust the brightness of the steady burning lights. Either console can be used to effect a change in either system by depressing the appropriate combination of "address" and "function" buttons. The code for the MALS at runway 27L is shown in Figure 3-23.

When the system is turned on, both steady lights and sequence flashers are activated. The brightness of the steady lights can be adjusted in three brightness levels. The sequence flashers have no brightness adjustment and cannot be turned off independent of the other lights. The console contains no indications of the functioning of the lights and it contains no alarms.

The console controls provide the following functions:

POWER - Indicator light showing whether the console is receiving power.

XMIT - Indicator light showing whether the two "SEND" buttons are being depressed simultaneously.

ON/OFF - Switch which turns power to the console on or off.

ADDRESS - Buttons used to select first three numbers in code used to operate lights (Figure 3-23).

FUNCTION- Buttons used to select 4th number in code.

SEND - When code has been selected to operate field units, both "SEND" buttons must be depressed simultaneously to send the command.

B. Deployment in TRACON

None located in TRACON

C. Deployment in cab

The MALS consoles are located by the LC-1 and LC-3 positions (Figure 3-13) and used by these or other controllers responsible for runways 27L and 26. They usually do not make brightness changes; it is set on high or low depending upon the weather. Pilots do not ask for changes in brightness, but they do occasionally ask that the "rabbit" be turned off. Controllers determine the operating status of the MALS through direct viewing with binoculars from the tower. The lights on 26 cannot be seen from the tower and so are always left on, even when using runway 8.

4. CURRENT FLIGHT DATA SYSTEM AT THE HARTSFIELD-ATLANTA TOWER CAB/TRACON

This section describes the current Flight Data System at Atlanta that TIPS proposes to displace. The description covers the:

- o Overall purpose and evolution of the National Flight Data System
- o Flight data equipment and layout at Atlanta
- o Flight strips/scratch pads
- o Flight data layout/utilization by position at Atlanta

4.1 PURPOSE AND EVOLUTION OF THE NATIONAL FLIGHT DATA SYSTEM

To efficiently handle the flights in FAA controlled airspace and at FAA controlled airports, controllers need certain information on each flight. This information is called flight data and includes such items as an aircraft's flight number, the type of aircraft being flown, and the pilot's planned route. Originally, all flight data was received by controllers via the voice radio link with pilots. This data was maintained by the controllers on blackboards and scratch pads.

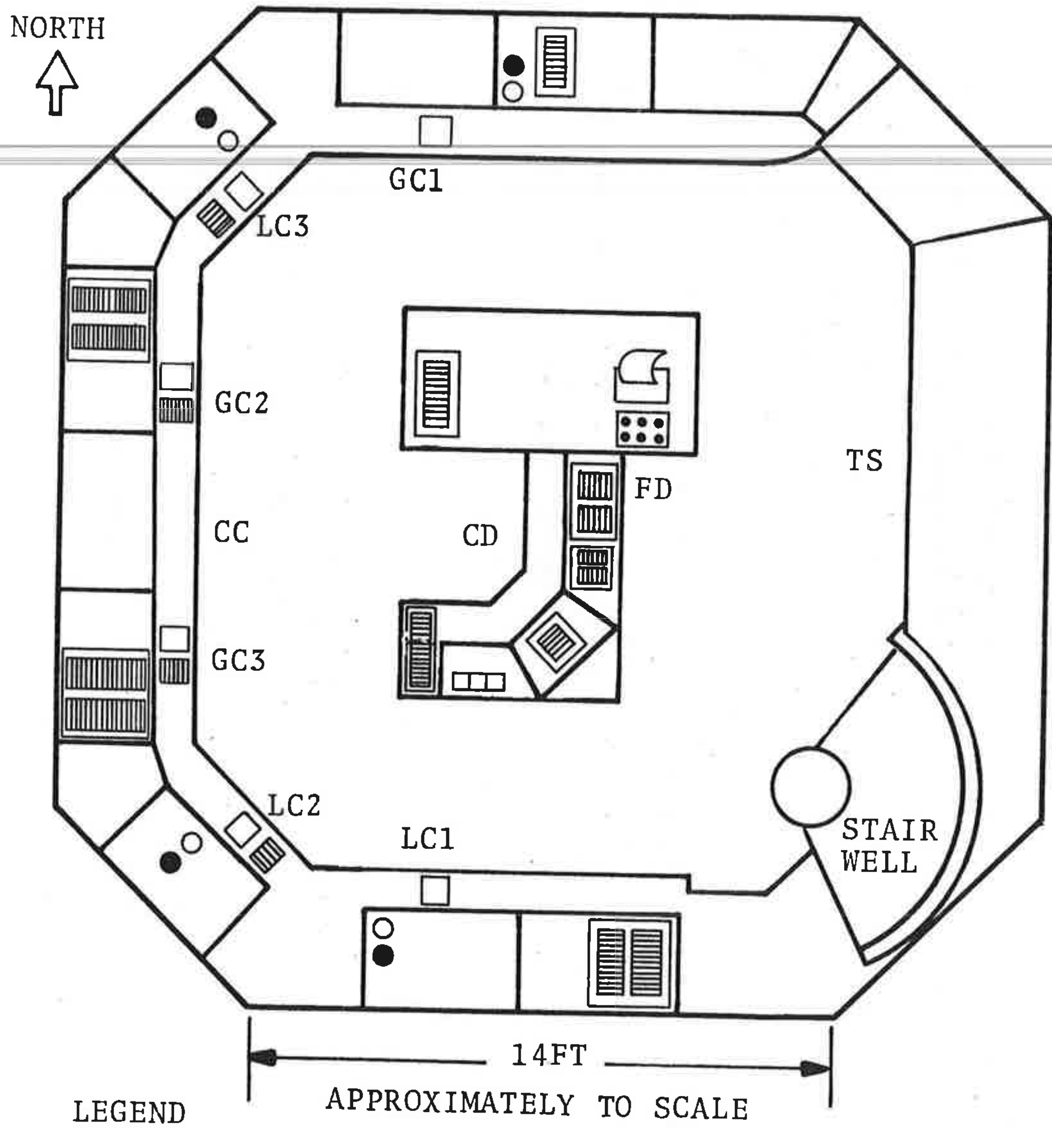
Today the Flight Data System has evolved into a nationwide computer based system that contains the flight data on all flights that plan to fly in FAA controlled enroute airspace. Pilots provide this information to the system prior to takeoff in the form of flight plans and controllers receive the flight data on these flights in the form of printed 1 by 8 inch paper strips called flight progress strips. Limited flight data is also provided to controllers on their surveillence displays. For those flights without a printed flight progress strip, controllers note the pertinent flight data on either a blank flight strip or a scratch pad. Controllers continue to use the voice radio link with pilots to supplement, confirm, or modify their flight data as required. In addition to maintaining flight data, controllers use this paper oriented system to maintain other traffic management information, such as noting how a flight is to be handled or noting that a particular instruction has been issued to the pilot.

The next major step in the evolution of the Flight Data System being considered by the FAA is to replace the paper flight strip with electronically displayed flight data. The system being designed for terminal areas is called the Terminal Information Processing System or TIPS.

4.2 FLIGHT DATA EQUIPMENT AND LAYOUT AT ATLANTA

The layouts of the flight data equipment in the Atlanta Tower Cab and TRACON are presented in Figures 4-1 and 4-2 respectively. For IFR flights, flight data is printed out on Flight Data Entry and Printout (FDEP) units, Figure 4-3, in the Tower Cab and TRACON about 30 minutes before the flights are expected to come under the control of these two facilities. There is one FDEP unit in the Tower Cab and four units in the TRACON as follows:

- Tower Cab Unit - prints out all IFR filed departures from Hartsfield-Atlanta. The location of the FDEP unit shown in Figure 4-1 is for Flight Data useage. When that position is not staffed, the unit can be shifted to the left on a set of tracks and be positioned for use by Clearance Delivery.
- AH-2 Unit in TRACON - prints out all IFR filed Hartsfield-Atlanta arrivals entering the terminal area via the two northern arrival gates (Figure 2-1).
- AH-3 Unit in TRACON - prints out all IFR filed Hartsfield-Atlanta arrivals entering the terminal area via the two southern arrival gates (Figure 2-1).
- SATH-1 Unit in TRACON - prints out all IFR filed arrivals and departures from the satellite-airports under the jurisdiction of the Atlanta TRACON.
- DH-3 Unit in TRACON - not used in this configuration; it is primarily used during the midnight shift when all TRACON radar positions are consolidated into the DR1 and DR-3 positions.



LEGEND

FDEP PRINTER

FDEP KEYBOARD

MOUNTED FLIGHT-STRIP TRAY

PORTABLE FLIGHT-STRIP TRAY

SCRATCH PAD

STRIP DROP TUBE TO TRACON (SATELLITE)

STRIP DROP TUBE TO TRACON (DEPARTURE)

FIGURE 4-1. LAYOUT OF FLIGHT DATA EQUIPMENT IN THE ATL TOWER CAB

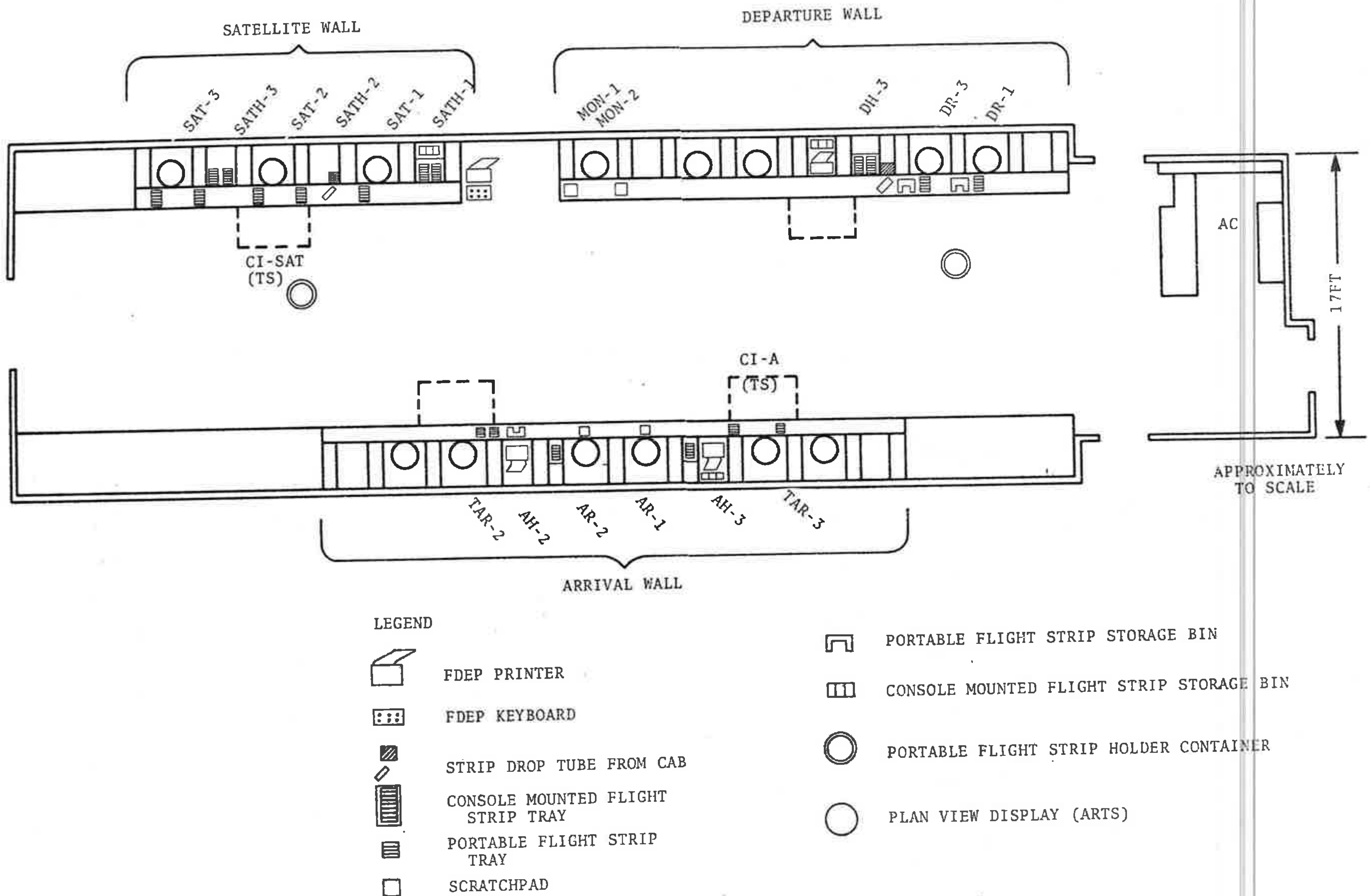


FIGURE 4-2. FLIGHT DATA EQUIPMENT LAYOUT IN THE ATL TRACON

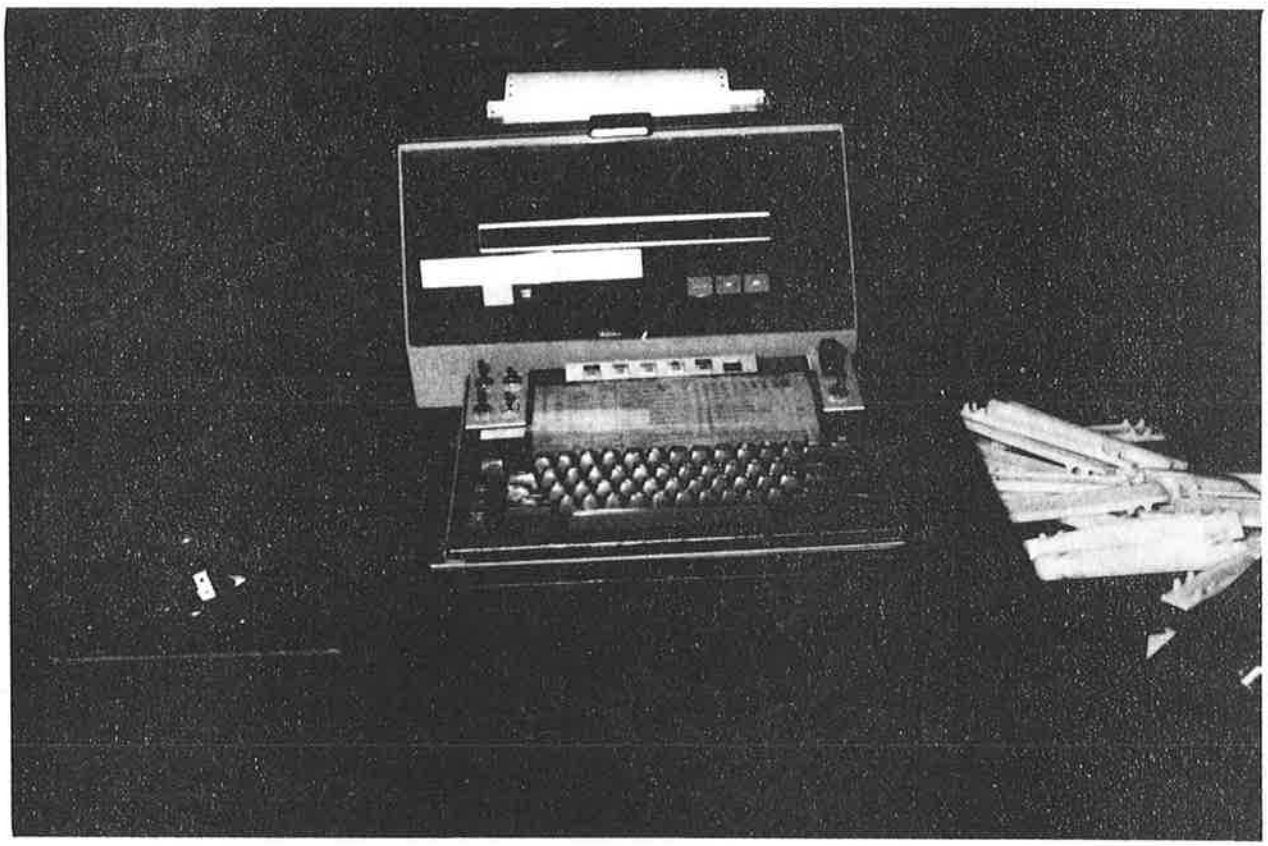


FIGURE 4-3. FLIGHT DATA ENTRY AND PRINTOUT (FDEP) UNIT

From this listing, it is seen that the Tower Cab does not receive any printed flight data for arrivals. The controllers use scratch pads to keep track of the arrival flight numbers and any other pertinent information. Figure 4-4 shows a typical scratch pad. Scratch pads are used extensively in the Tower Cab and in the TRACON at the Final Control (AR) and Monitor (MON) positions.

From this listing, it is also seen that the FDEP units are located at the support controller position (i.e., the handoff and clearance delivery positions). The controllers at these positions are responsible for putting the typewritten flight strips into individual holders and then putting the strips into the appropriate flight strip trays. Some trays are mounted directly into the controller consoles while other trays are portable and are located on the counter at the controller positions, Figure 2-51. The number and function of the flight strip trays found at each position in the Tower Cab is presented in Table 4-1 and, for the TRACON, in Table 4-2.

Finally, concerning the FDEP unit, the keyboard portion is used by the controller to communicate with the computer-stored flight data base in terms of inputting, requesting, and modifying flight data. The computer used is the 9020 NAS Stage A unit. Each En Route Center in the country has such a unit with which flight data is stored and exchanged with other centers and with the Center's client TRACON's and control towers.

Flight strip drop tubes are used at Atlanta to transport the departure flight strips from the Tower Cab to the TRACON as each departure is given clearance to takeoff. Each Local Control position has two drop tubes - one leads to the satellite positions for local or low flying departures and the other tube goes to the departure positions for the routine airline departures linking up with the en route airways. Figure 4-5 shows one of the drop tube entrances in the Tower Cab and one of the TRACON exists.

When the departures leave the Terminal Area, the departure and

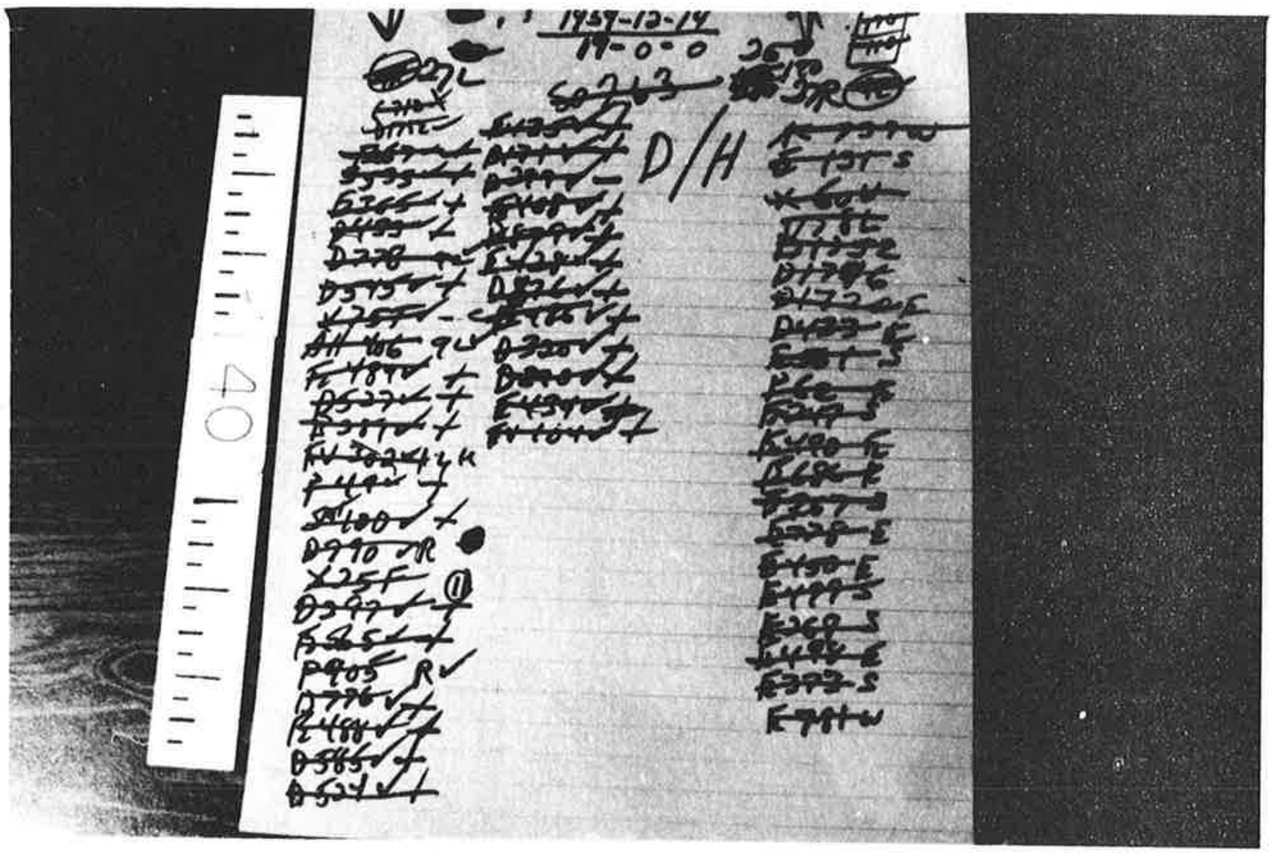


FIGURE 4-4. SCRATCHPAD

TABLE 4-1. FUNCTION OF FLIGHT STRIP TRAYS AND SCRATCHPADS IN TOWER CAB (FOR TYPICAL FLIGHT DATA SETUP DURING DAILY PEAK HOURS)

POSITION	PRIMARY FUNCTIONS OF POSITION	TRAYS/SCRATCHPADS AT POSITION (FIGURE 4-1)	TRAY/SCRATCHPAD FUNCTION
CD	To Transmit IFR Clearances To ATL Departures	4 Console Mounted Trays Located To East of CD	To Hold Departure Flight Strips Prior To Delivery Of Clearance
	To Obtain TCA Clearances For VFR ATL Departures	1 Console Mounted Tray Located To Southeast of CD	To Hold VFR Departure Flight Strips Prior To Delivery of TCA Clearance
	To Handoff ATL Departure Strips To GC Position After Clearances Read	1 Console Mounted Tray Located To North of CD	To Hold Flight Strips For GC-2 After Clearances Read
		1 Console Mounted Tray Located To South Of CD	To Hold Flight Strips For GC-3 After Clearances Read
GC-1	Excluded From Example Setup-Not Staffed Daily		
GC-2	To Service Departures From East Side Of Terminal Ramp Area To Runways	2 Console Mounted Trays	To Hold Dep. Flight Strips Prior To Pilots Request For Taxi Instructions
		1 Portable Tray	To Hold Departures That Are Under Control Of Position
	To Service Arrivals From Runways To East Side Terminal Ramp Area	1 Scratchpad	To Hold Flight Data on Arrivals
GC-3	To Service Departures From West Side Of Terminal Ramp Area To Runways	2 Console Mounted Trays	To Hold Dep. Flight Strips Prior To Pilots Request For Taxi Instructions
		1 Portable Tray	To Hold Departures That Are Under Control Of Position
		1 Scratchpad	To Hold Flight Data On Arrivals

TABLE 4-1. FUNCTION OF FLIGHT STRIP TRAYS AND SCRATCHPADS IN TOWER CAB (FOR TYPICAL FLIGHT DATA SETUP DURING DAILY PEAK HOURS) (Cont'd)

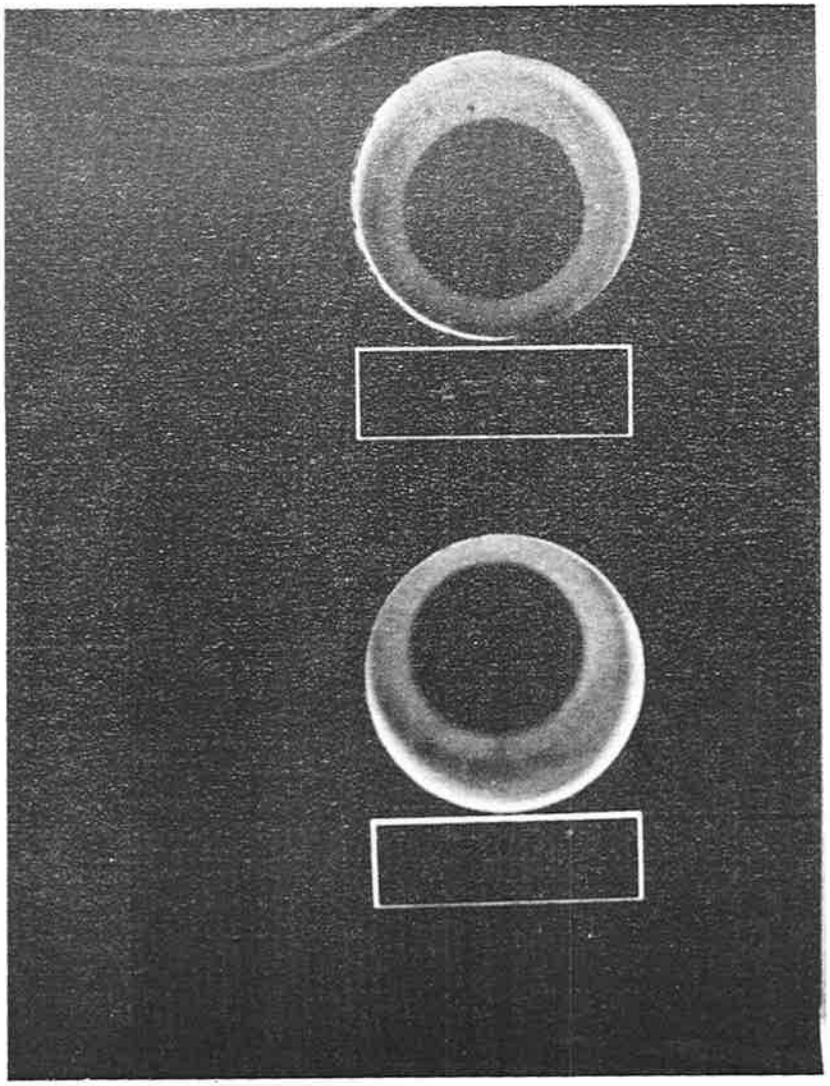
POSITION	PRIMARY FUNCTIONS OF POSITION	TRAYS/SCRATCHPADS AT POSITION (FIGURE 4-1)	TRAY/SCRATCHPAD FUNCTION
LC-1	To Service Arrivals/Departures On 9R/27L (Primarily An Arrival Runway)	1 Scratchpad	To List Arrivals And Departures
LC-2	To Service Arrivals/Departures On 9L/27R	1 Portable Tray	To Hold Dep. Flight Strips On Flights Under Control Of Position
		1 Scratchpad	To List Arrivals And Departures
LC-3	To Service Arrivals/Departures On 8/26	1 Portable Tray	To Hold Dep. Flight Strips On Flights Under Control Of Position
		1 Scratchpad	To List Arrivals And Departures

TABLE 4-2. FUNCTION OF FLIGHT STRIP TRAYS/SCRATCHPADS IN TRACON (FOR TYPICAL FLIGHT DATA SETUP DURING DAILY PEAK HOURS)

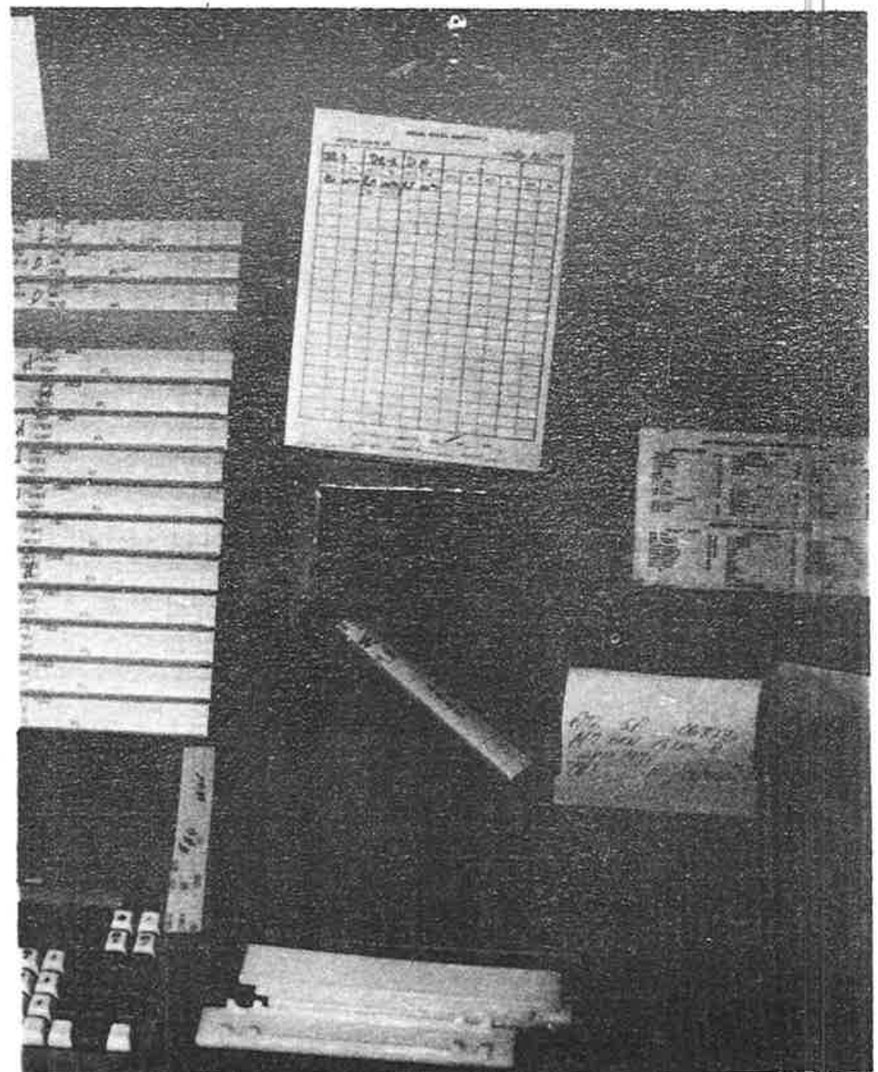
POSITION	PRIMARY FUNCTIONS OF POSITION	TRAYS/SCRATCHPADS AT POSITION (FIGURE 4-2)	TRAY/SCRATCHPAD FUNCTION
TAR-2	To Service ATL Arrivals From Northern Arrival Gates To Just Prior To Localizer Turn On To 8/26	1 Portable Tray	To Hold Flight Strips Of Flights Under Control Of Position
AH-2	To Assist TAR-2	1 Portable Tray	To Hold Flight Strips Of Arrivals Prior To An En Route ARTS Handoff
AR-2	To Service ATL Arrivals Turning Onto 8/26	1 Console Mounted Tray 1 Scratch Pad	Not Used To List Arrivals
MON-2	To Monitor Separation Of 8/26 Traffic On Final Approach Relative To 9L/27R Arrival Traffic	1 Scratchpad	To List Arrivals
TAR-3 AH-3 AR-1 MON-1	Same As Above Except For Servicing Arrivals From Southern Arrival Gates to Runway 9L/27R		
DR-1	To Service ATL Departures Leaving Through The Southern/Eastern Gates To Service IFR Turbojet Departures From Satellite Airports Through These Gates To Service ATL Arrivals Approaching ATL At 6000 Ft. On Downwind Side	1 Portable Tray	To Hold Flight Strips Of Flights Under Control Of Position
DR-3	Same As For DR-1 Except For Servicing Departures Leaving Through Northern/Western Gates		

TABLE 4-2. FUNCTIONS OF FLIGHT STRIP TRAYS/SCRATCHPADS IN TRACON (FOR TYPICAL FLIGHT DATA SETUP DURING DAILY PEAK HOURS) (Cont'd)

POSITION	PRIMARY FUNCTIONS OF POSITIONS	TRAYS/SCRATCHPADS AT POSITION (FIGURE 4-2)	TRAY/SCRATCHPAD FUNCTION
SAT-1	To Service IFR Arrivals/ Departures At Satellite Airports Located To Northeast Of ATL And Low Flying Overflights Through That Quadrant	1 Portable Tray	To Hold Flight Strips of Flights Under Control Of Position
SATH-1	To Assist SAT-1	2 Console Mounted Trays	To Hold Flight Strips of Flights Prior to Coming Under Control Of SAT-1
SAT-2 SATH-2	Same As For SAT-1/SATH-1 Except That Traffic In Northwest Quadrant Handled and SATH-2 Has 1 Portable Tray - Not 2 Console Mounted Trays		
SAT-3 SATH-3	Same As For SAT-1/SATH-1 Except That Traffic In 2 Southern Quadrants Handled and SATH-3 Has 1 Portable Tray - Not 2 Console Mounted Trays		



CAB ENTRANCE



TRACON EXIT

FIGURE 4-5. FLIGHT STRIP CAB-TO-TRACON DROP TUBE satellite controllers remove the flight strips from their holders and throw the holders into large plastic barrels. These collected holders are periodically taken back to the Tower Cab for reuse, Figure 4-6.

All flight strips are kept after being used, for later collection and counting. The strips are temporarily stored in storage bins located throughout the TRACON, Figure 4-7.

4.3 FLIGHT STRIPS/ SCRATCHPADS

Flight data is maintained in the Tower Cab/TRACON by means of printed flight strips, handwritten flight strips, and scratchpads.

4.3.1 Printed Flight Strips

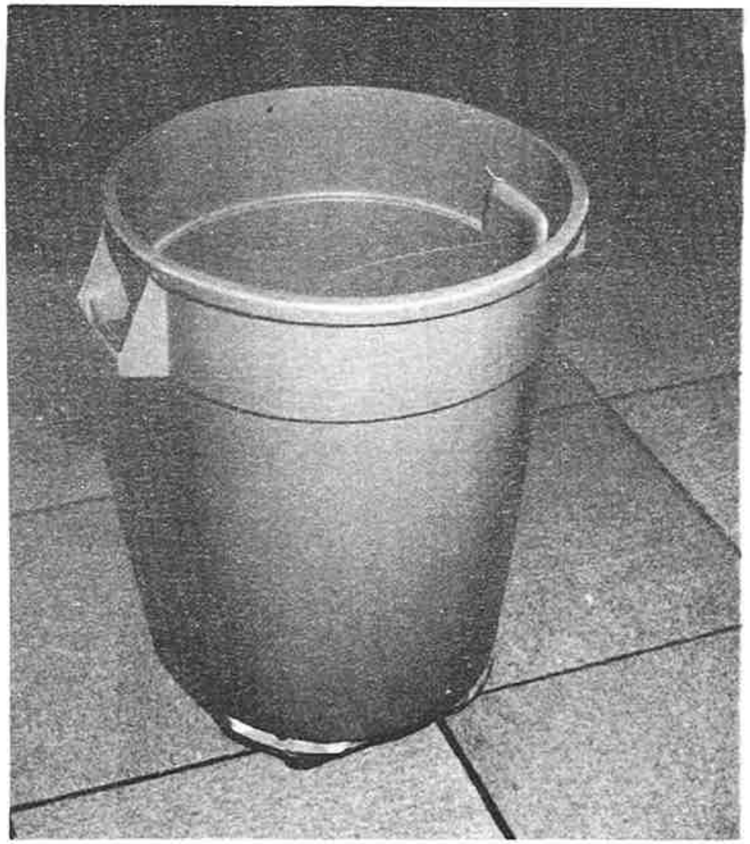
The flight strip printed out on the FDEP is the predominant form in which flight data is kept in the TRACON and to a lesser extent in the Tower Cab. These strips are provided for those flights which prefiled IFR flight plans.

There are 3 types of operations handled by Atlanta controllers - arrivals, departures, and overflights. Correspondingly, there are 3 basic flight strip formats.

- o Format for arrivals to Hartsfield-Atlanta and secondary - airports, Figure 4-8.
- o Format for departures from Hartsfield-Atlanta and secondary airports, Figure 4-9.
- o Format for overflights through the Atlanta Terminal Area, Figure 4-10.

These flight strips provide a great deal of typewritten information. However, controllers also make handwritten notations on the flight strips. A survey of these notations is presented in Appendix A. The survey shows that these handwritten notations can be extensive - six or more per flight strip are common. The purposes of these notations are varied and include:

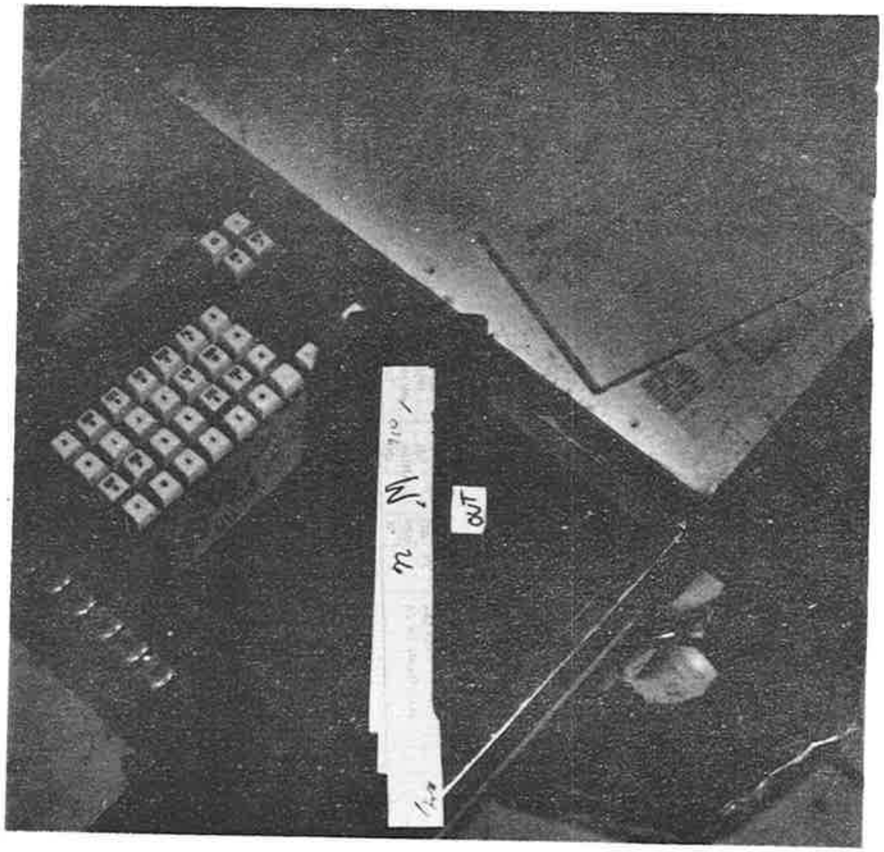
- o Noting changes to the typewritten flight data (e.g.,



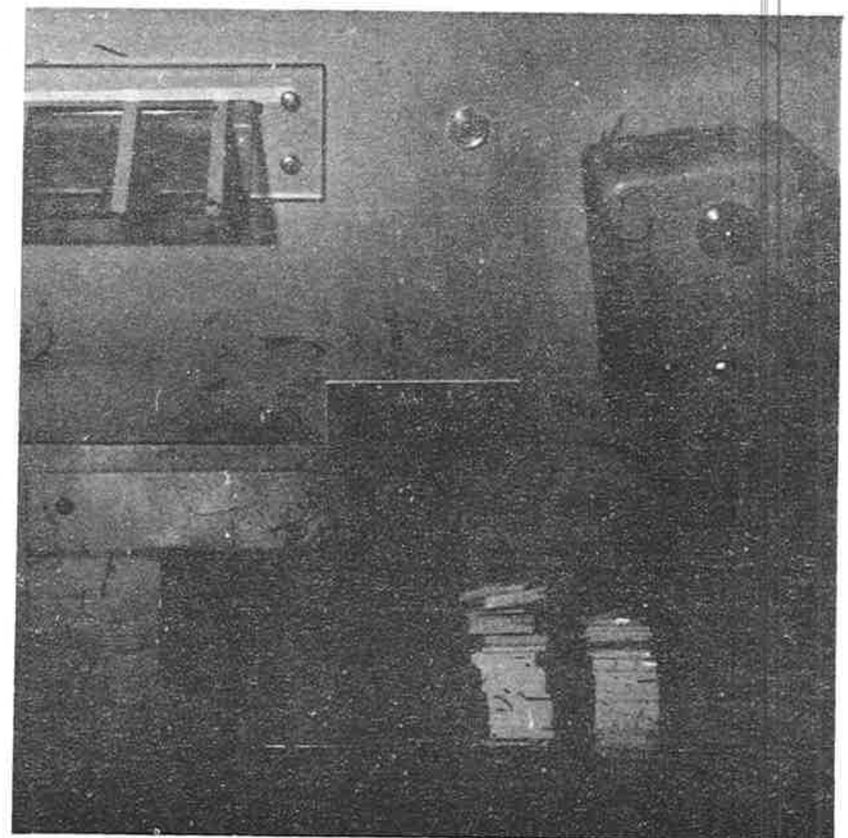
Collection Barrel in TRACON

Empty Holders Returned to Tower Cab

FIGURE 4-6. BARRELS FOR EMPTY FLIGHT STRIP HOLDERS



Portable Flight Strip Storage Bin



Console Mounted Flight Strip Storage Bins

FIGURE 4-7. FLIGHT STRIP STORAGE BINS

1. U 327 2. 3. D737/A 4.	5. 0317	8. 1031 A. √	9. 110 9B. ILS√ 9A. FTY 9C. T	10. 34	11.	12. 40
	6. AHN			13.	14.	15. 42
	7. OCR			16.	17.	18.

TYPED OUT INFORMATION

1. Aircraft identification.
2. Revision number.
3. Number of aircraft, if more than one, type of aircraft, and suffix indicating any special equipment; e.g., DME, transponder, heavy, etc.
4. Computer identification number.
5. Secondary radar (beacon) code assigned.
6. Previous fix.
7. Coordination fix.
8. Estimated time of arrival at the coordination fix or destination airport.

9A. Destination airport.

HANDWRITTEN INFORMATION

8A. (√) when inbound given to Satellite.
9. Altitude (in hundreds of feet) and remarks.

9B. Type approach to expect, enter (√) when given to Satellite.
9C. A large T to indicate tower en route.
10. Pattern time (minutes) outer fix.
12. Control time.
15. EFC/EAC.

AREAS NOT USED

11	14	17
13	16	18

FIGURE 4-8. FLIGHT STRIP FORMAT FOR ARRIVALS TO HARTSFIELD-ATLANTA AND SECONDARY AIRPORTS

1. U427 2.	5. 1027	8. ATL	9.	10.	11. 11	12. 30
3. B737/A 4.	6. 1101	A. 36	ACD AGS 2CY Filed Route	13.	14.	15. √
A. E	7. 170	B. 9L	A. CSFP B. T	16. 10	17. 15	18. 20

TYPED OUT INFORMATION

1. Aircraft identification.
2. Revision number.
3. Number of aircraft, if more than one, type of aircraft, and suffix indicating any special equipment; e.g., DME, transponder, heavy, etc.
4. Computer identification number.
5. Secondary radar (beacon) code assigned.
6. Proposed departure time.
7. Requested altitude.
8. Departure airport.
9. Route, destination
9A. Computer stored flight plan (CSFP).

HANDWRITTEN INFORMATION

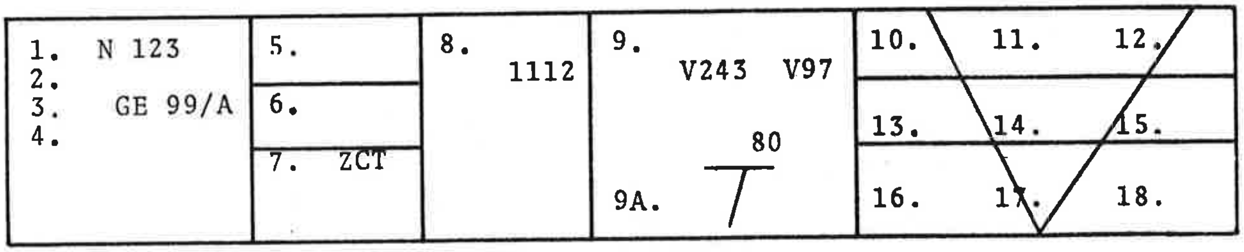
4A. Departure vector area.
8A. Gate number.
8B. Runway.
9. Manual altitude/restrictions if appropriate.

9B. A large T to indicate tower en route.
10. Expect start engine time (minutes).
11. Departure time (hour).
12. Departure time (minutes).
13. Revised start engine time (minutes).
15. ✓ Clearance read.
16. Time aircraft calls ready to start (minutes).
17. Time you advise pilot to start engines (minutes).
18. Time aircraft advised ready to taxi (minutes).

AREAS NOT USED

14

FIGURE 4-9. FLIGHT STRIP FORMAT FOR DEPARTURES FROM HARTSFIELD-ATLANTA AND SECONDARY AIRPORTS



- TYPED OUT INFORMATION

  1. Aircraft identification.
  2. Revision number.
  3. Number of aircraft, if more than one, type of aircraft, and suffix indicating any special equipment; e.g., DME, transponder, heavy, etc.
  4. Computer identification number.
  5. Secondary radar code (beacon) assigned.
  6. Coordination fix.
  7. Facility to which FD forwarded.
  8. Estimated time at coordination fix.
  9. Altitude and route of flight through terminal area.

HANDWRITTEN INFORMATION

9A. A large T to indicate tower en route.
10. thru 18 -- except 13 - A large V to indicate overflight
13. Control time.

FIGURE 4-10. FLIGHT STRIP FORMAT FOR OVERFLIGHTS THROUGH THE ATLANTA TERMINAL AREA destination airport changed, Table A-1).

- o Emphasizing information critical to the handling of the flight even though it already is typed out on the flight strip (e.g., the coordination fixes are emphasized on arrival flight strips, Table A-1).
- o Noting critical information to be used in the handling of the flight (e.g., the type of approach to be made to a satellite airport, Table A-1).
- o Noting that a particular instruction has been issued to the pilot (e.g., altitude instructions, Table A-1).
- o Noting that required inter-controller coordination has taken place (e.g., a notation is made when approach information is passed from the TRACON to the control tower of a flight's destination satellite airport).
- o Noting information for other than controller purposes such as for traffic counting or incident reconstruction (e.g., a T marked on Tower En Route Controlled flights)

The paper flight strip is being used by controllers for more than maintaining flight data. Controllers are using flight strips to note their intentions in handling a flight, particularly if the handling is not to be routine. The controllers also note operational events as they occur, such as issuing a particular instruction to a pilot or completing a necessary item of intercontroller coordination concerning a flight.

4.3.2 Handwritten Flight Strips

Some flights operating out of Hartsfield-Atlanta and the satellite airports are local and do not require IFR flight plans, and yet they fly within the Terminal Control Area (Figure 2-6). All traffic within the TCA is under TRACON control. For these flights, printed flight strips are not available; and controllers take blank flight strip forms and write out the flight data.

The use of handwritten flight strips in the Atlanta TRACON is not extensive. The flight strips from a VFR weekday were sorted and the number of handwritten strips were found to total 130 out of 2017 operations, Table 4-3. This was 6% of the traffic handled by the TRACON.

Typical examples of handwritten flight strips as compared with printed flight strips for the 5 basic types of operations handled by the TRACON are presented in the following figures:

- o Figure 4-11, Hartsfield-Atlanta Arrivals
- o Figure 4-12, Hartsfield-Atlanta Departures
- o Figure 4-13, Satellite Airport Arrivals
- o Figure 4-14, Satellite Airport Departures
- o Figure 4-15, Overflights

4.3.3 Scratch Pads

Scratch pads are used by controllers to note pertinent operational information whenever flight strips are not available or full flight strips are not required. The use of scratch pads in the Tower Cab is extensive - used by all the local and ground control positions. Both the local and ground controllers use their scratch pads to note the flight numbers of arrivals, since arrival flight strips are not available in the Tower Cab. The local controllers also note the departure flight numbers even though departure flight strips are at their positions. This is due to the fact that the local controllers drop the departure flight strips to the TRACON after issuing takeoff clearances so the TRACON controllers will be ready to accept the departures at handoff. The local controllers will then refer to the departure list on the scratch pad for flight numbers as needed during the minute or two between issuing takeoff clearance and handoff.

In the TRACON, scratch pads are used at the Final Control (AR) and Monitor (MON) positions for arrivals. Arrival flight strips are available in the TRACON but are not needed at these positions. The primary flight data needed by these positions are flight number and aircraft type, both of which are displayed on the ARTS Plan View Display (PVD). A scratch pad is used at these positions to note the arrival flight numbers. This is done so the controller will be

TABLE 4-3. FLIGHT STRIP BREAKDOWN FOR THE ATLANTA TRACON FOR AN EXAMPLE WEEKDAY UNDER VFR CONDITIONS

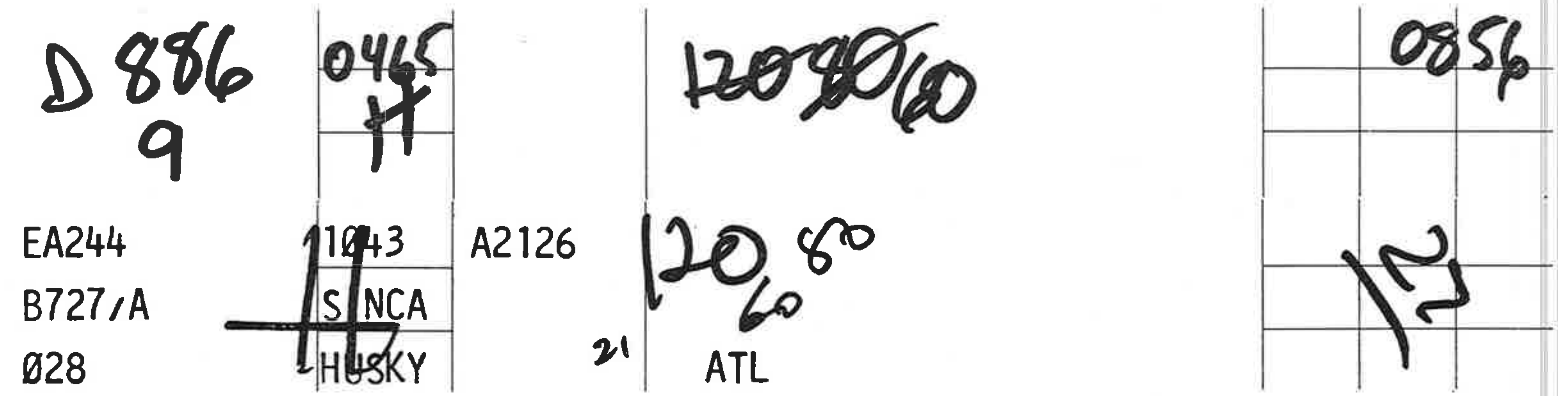
TYPE OF TRACON OPERATION	NUMBER OF FLIGHT STRIPS HANDLED BY: ARRIVAL RADAR POSITIONS	DEPARTURE RADAR POSITIONS	SATELLITE RADAR POSITIONS	TOTAL NUMBER OF TRACON FLIGHT STRIPS
HARTSFIELD-ATLANTA				
ARRIVALS	825 : 34*[1]	25 : 0	6 : 2	856 : 36
DEPARTURES	0 : 0	725 : 5	125 : 36	850 : 41
SATELLITE AIRPORTS				
ARRIVALS	0 : 0	0 : 0	171 : 52	171 : 52
DEPARTURES	0 : 0	61 : 0	130 : 0	130*[2] : 0
OVERFLIGHTS	0 : 0	1 : 1	9 : 0	10 : 1
TOTALS	825 : 34	812 : 6	441 : 90	2017 : 130*[3]

NOTES

*[1] Format A : B where A Is The Total Number Of Flight Strips Handled, Both Printed And Handwritten and B Is The Total Number Of Handwritten Flight Strips Handled.

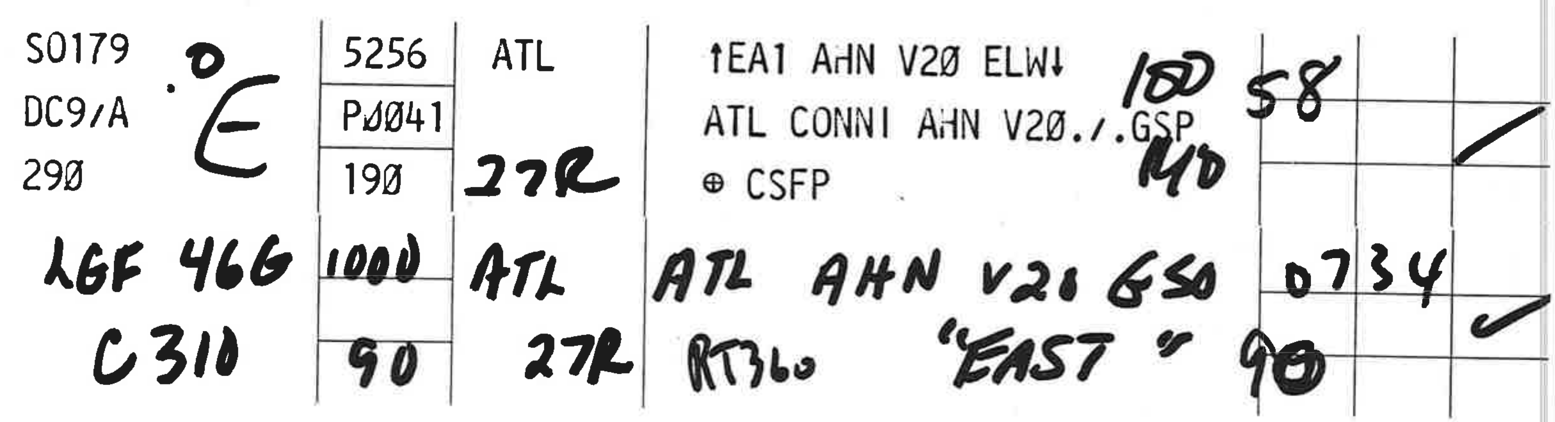
*[2] Of The 130 Operations Of This Type Handled By SAT, 61 Entered DR Airspace And So Were Also Handled By DR - The 61 Flight Strips Are Only Counted Once In The Total.

*[3] Only 6% Of The Flight Strips Were Handwritten.



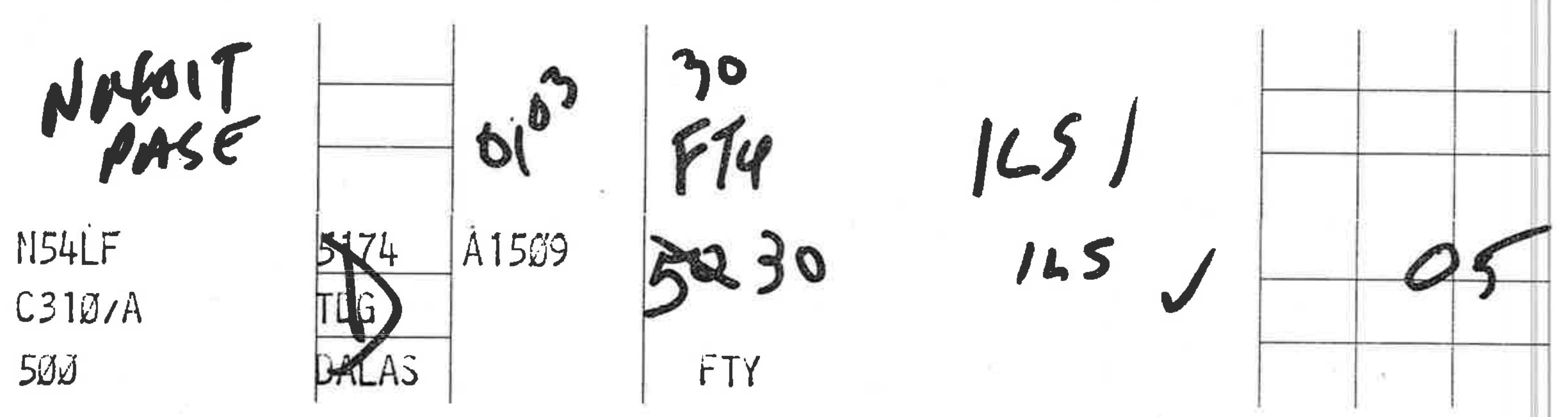
EA244	D886	AIRCRAFT IDENTITY
B727/A	9	AIRCRAFT TYPE/TRANSPONDER EQUIPMENT
028	-	COMPUTER ID NUMBER
1043	0465	ASSIGNED BEACON CODE
SINCA	-	PREVIOUS FIX
HUSKY	-	COORDINATION FIX
A2126	-	ETA AT COORDINATION FIX
ATL	-	DESTINATION AIRPORT
H	H	COORDINATION FIX ABBREVIATION
120 80 60	~~120~~ ~~80~~ 60	ALTITUDE ASSIGNMENTS (100's OF FEET)
21	-	AIRCRAFT SPEED ASSIGNMENT (210 KTS)
22	0856	TIME FLIGHT CAME UNDER TRACON CONTROL

FIGURE 4-11. TYPICAL ATLANTA TRACON FLIGHT STRIPS FOR ARRIVALS TO HARTSFIELD-ATLANTA



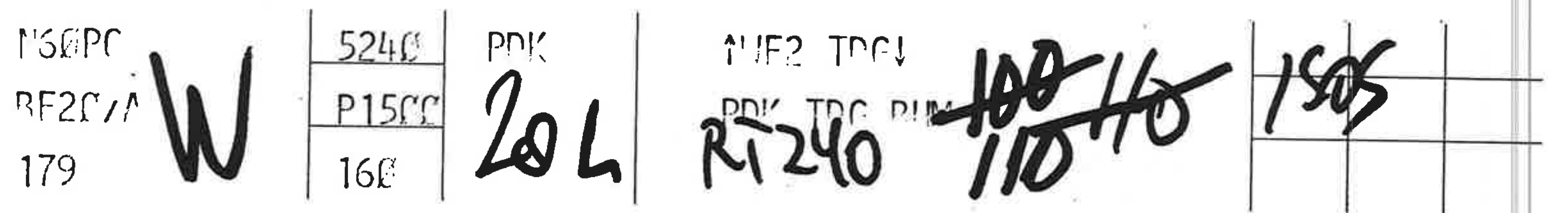
S0179	LGF46G	AIRCRAFT IDENTITY
DC9/A	C310	AIRCRAFT TYPE/TRANSPONDER EQUIPMENT
290	-	COMPUTER ID NUMBER
5256	1000	ASSIGNED BEACON CODE
P0041	-	PROPOSED DEPARTURE TIME
190	90	REQUESTED ALTITUDE (100's OF FEET)
ATL	ATL	DEPARTURE AIRPORT
↑EAI AHN V20..	ATL AHN V20..	DEPARTURE ROUTE
E	EAST	DEPARTURE GATE (SEE FIGURE 2-1)
.0	-	DEPARTURE CONTROL FREQUENCY 125.0
27R	27R	DEPARTURE RUNWAY ASSIGNMENT
100 140	90	ALTITUDE ASSIGNMENTS (100's OF FEET)
-	RT360	RIGHT TURN INSTRUCTION
58	0734	DEPARTURE TIME (LIFT OFF)
✓	✓	CLEARANCE READ TO PILOT

FIGURE 4-12. TYPICAL ATLANTA TOWER CAB/TRACON FLIGHT STRIPS FOR DEPARTURES FROM HARTSFIELD-ATLANTA



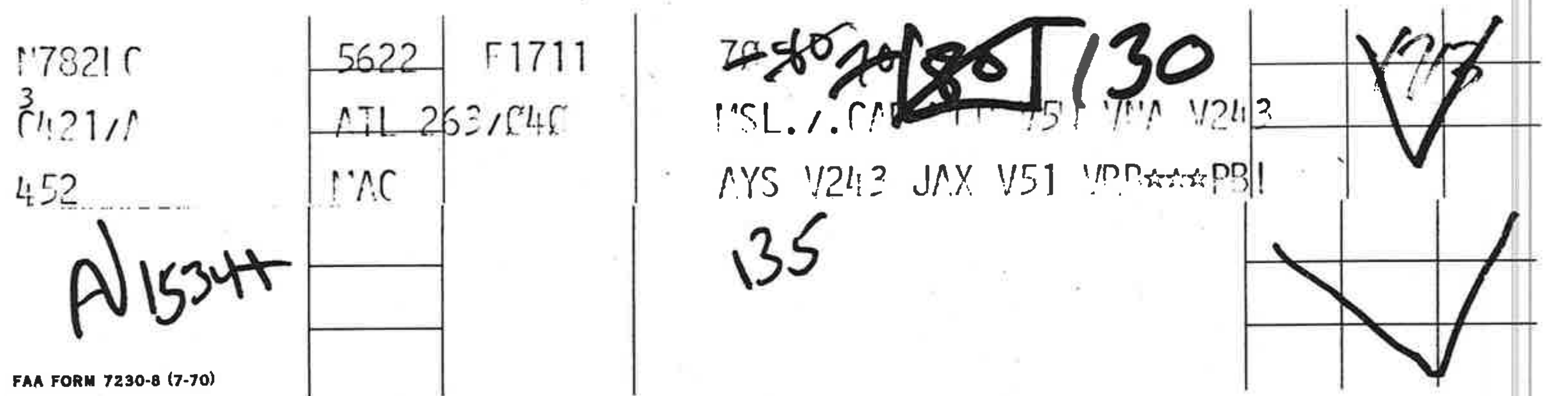
N54LF	N1401T	AIRCRAFT IDENTITY
C310/A	PASE	AIRCRAFT TYPE/TRANSPONDER EQUIPMENT
500	-	COMPUTER ID NUMBER
5174	-	ASSIGNED BEACON CODE
TDG	-	PREVIOUS FIX
DALAS	-	COORDINATION FIX
A1509	-	ETA AT COORDINATION FIX
FTY	FTY	DESTINATION AIRPORT (CHARLIE BROWN COUNTY)
D	-	COORDINATION FIX ABBREVIATION
~~50~~ 30	30	ALTITUDE ASSIGNMENTS (100's OF FEET)
ILS	ILS	TYPE OF APPROACH TO BE MADE
V	V	TYPE OF APPROACH GIVEN TO SATELLITE AIRPORT CONTROL TOWER
05	0103	TIME FLIGHT GAME UNDER TRACON CONTROL

FIGURE 4-13. TYPICAL ATLANTA TRACON FLIGHT STRIPS FOR ARRIVALS TO SATELLITE AIRPORTS



N60PC	AIRCRAFT IDENTITY
BE20/A	AIRCRAFT TYPE/TRANSPONDER EQUIPMENT
179	COMPUTER ID NUMBER
5240	ASSIGNED BEACON CODE
P1500	PROPOSED DEPARTURE TIME
160	REQUESTED ALTITUDE (100's OF FEET)
PDIC	DEPARTURE AIRPORT (DEKALB-PEACHTREE)
4WF2 TDG↓	CHANGE TO REQUESTED ROUTE WITH DEP. GATE WEST-2 (FIGURE 2-1)
PDK.TDG BAM	REQUESTED FLIGHT PLAN
W	DEPARTURE VECTOR AREA
20L	DEPARTURE RUNWAY ASSIGNMENT
RT240	HEADING INSTRUCTION
~~40~~ ~~100~~ 110	ALTITUDE ASSIGNMENTS (100's OF FEET)
1505	DEPARTURE TIME (TIME OF RADAR CONTACT AFTER LIFT OFF)

FIGURE 4-14. TYPICAL ATLANTA TRACON FLIGHT STRIP FOR DEPARTURES FROM SATELLITE AIRPORTS



N7 82LC	N1534T	
N782LC	N1534T	AIRCRAFT IDENTITY
3	-	REVISION NUMBER
C421/A	-	AIRCRAFT TYPE/TRANSPONDER EQUIPMENT
452	-	COMPUTER ID NUMBER
5622	-	BEACON CODE ASSIGNMENT
ATL263/040	-	COORDINATION FIX (40 Mi FROM ATL VOR ON RADIAL 263 DEG)
MAC	-	FACILITY TO WHICH FLIGHT DATA FORWARDED (MACON GA.)
70	-	REQUESTED ALTITUDE
~~80~~ ~~70~~ ~~80~~ 130	135	ALTITUDE ASSIGNMENTS (100's OF FEET)
V	V	OVERFLIGHT SYMBOL
1713	-	TIME FLIGHT CAME UNDER TRACON CONTROL

FIGURE 4-15. TYPICAL ATLANTA TRACON FLIGHT STRIPS FOR OVERFLIGHTS THROUGH THE TERMINAL AREA

able to maintain unambiguous communication with the pilots in the events of an ARTS failure.

4.4 FLIGHT DATA LAYOUT/UTILIZATION BY POSITION

One means used to document the current Atlanta Flight Data System was to photograph the flight strip trays and scratch pads at each Cab/TRACON position during a busy traffic period. The photographic survey was conducted one weekday afternoon when the airport was going from rainy (IFR) to clear (VFR) conditions. The staffing and equipment layout in the Cab/TRACON during the survey was the same as shown in Figures 4-1 and 4-2 except that:

- o FD position was not staffed and the FDEP unit in the Cab was shifted on its track to the left so CD could assume the FD function.
- o GC-1 position was not staffed.
- o DH-3 position was not staffed.

The use of a camera provided a realistic recording of the flight data at various stages in the processing of flights. However, the use of a camera involved a small but necessary amount of interference with the working controllers in taking the photographs. The result is that for some high workload positions, like TAR-2, the trays could only be photographed during relatively low traffic levels.

To minimize the interference with controllers, all photographs were taken in ambient light conditions without the use of a flash. To compensate for the low light levels in the TRACON, fast film was used. This approach produced useable photographs, but the photographs exhibit strong shadow features.

4.4.1 Tower Cab Positions

4.4.1.1 Clearance Delivery (CD) - The primary duties of CD are to transmit IFR clearances to departures from Hartsfield-Atlanta with filed IFR flight plans and to transmit TCA clearances for those Atlanta departures without such flight plans. All flights through the Terminal Control Area (Figure 2-6) must be under control and have been assigned a beacon code. CD transmits the beacon code assignments to the departures from Hartsfield-Atlanta.

The layout of flight data at the CD position is presented in Figure 4-16. The flight strips are arranged in the trays in the following manner:

Tray B - Delta departures arranged numerically by their flight numbers

Tray A - Holds overflow Delta departures from Tray B and all other airline departures from the east side of the Terminal Complex

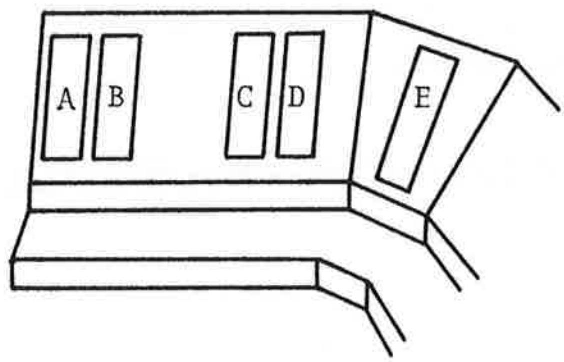
Tray C - Eastern departures arranged numerically by their flight numbers

Tray D - Holds overflow Eastern departures from Tray C and all other airline departures from the west side of the Terminal Complex

Tray E - Holds the handwritten flight strips of flights without filed IFR flight plans

The flight strips are typed out on the FDEP unit about 30 minutes before each flight is scheduled to depart. CD, if the Flight Data position is not staffed, will take the typewritten strips from the FDEP unit and put them in to individual, plastic holders. CD then puts the strips into the trays at his position and awaits the pilot call-in for flight plan clearance. CD will make a number of notations on the flight strips which include:

- o Flight plan changes such as:
  - o Changed beacon code assignment
  - o Changed proposed departure time
  - o Changes in the proposed route



CD POSITION SHOWING THE 5 MOUNTED 20-FLIGHT STRIP TRAYS

THE FOLLOWING PHOTOGRAPHS WERE TAKEN AT 2054z TIME (3:54 PM LOCAL TIME)

NUMBER OF FLIGHT STRIPS - 49
(75 IS THE TYPICAL DAILY MAXIMUM)

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP

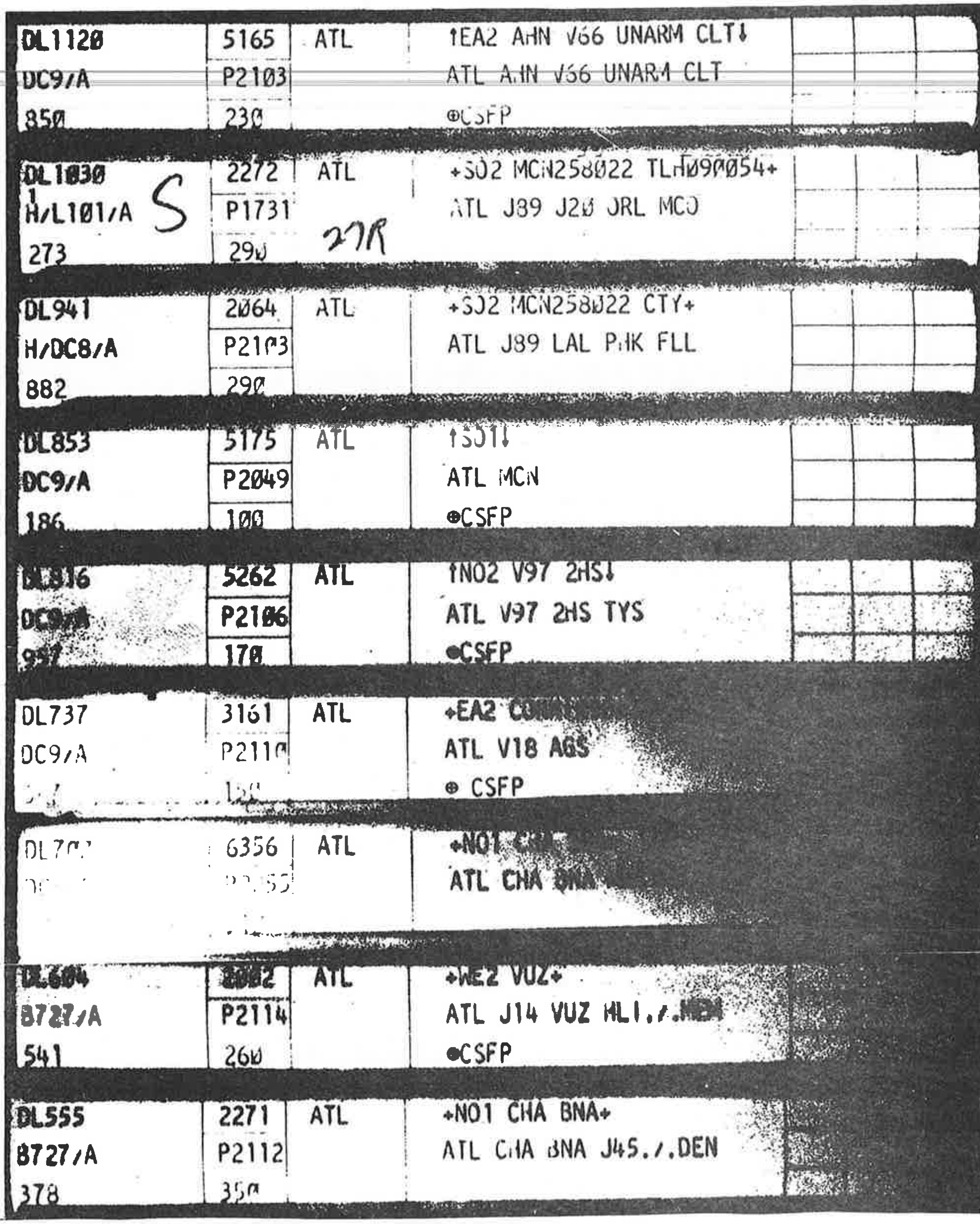
[illegible]	[illegible]		[illegible] MGM+ ATL J37 MSY
[illegible]	[illegible]		[illegible] 090010 CAE+ ATL CAE
[illegible]	[illegible]		[illegible] MCN AMG+ ATL J45 JAX ⊕CSFP
[illegible]	[illegible] 29Ø	ATL	↑EA2 AHN FML↓ ATL SPA RDU
[illegible]	[illegible] 16Ø	ATL	↑NE1 V18 V2ØN SEMAN↓ ATL V18 V2ØN SEMAN MGM ⊕CSFP
DL1153 H/L1Ø1/A 7[illegible]1	6334 P21Ø6 29Ø	ATL	ATL GNV ORL [illegible]
DL1132 H/L1Ø1/A 438	63Ø6 P211Ø 35Ø	ATL	+NØ1 MCH J89 LOU+ ATL J89 LAF CGT./.ORD
GEA4Ø1 BE18/U 316	2077 P173Ø 7Ø	ATL	+SØ1 MCN+ ATL MCN AMG JAX ⊕ CSFP
FRT451 DC3/A 5Ø1	5137 P17ØØ 6Ø	ATL	↑NE2 TDG↓ ATL TDG BHM
[illegible]137 [illegible]V64/A 339	2264 P21ØØ 14Ø	ATL	+NØ1 NELLO V5 BNA+ ATL BNA V52 CCT./.STL

S

W

TRAY A

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)



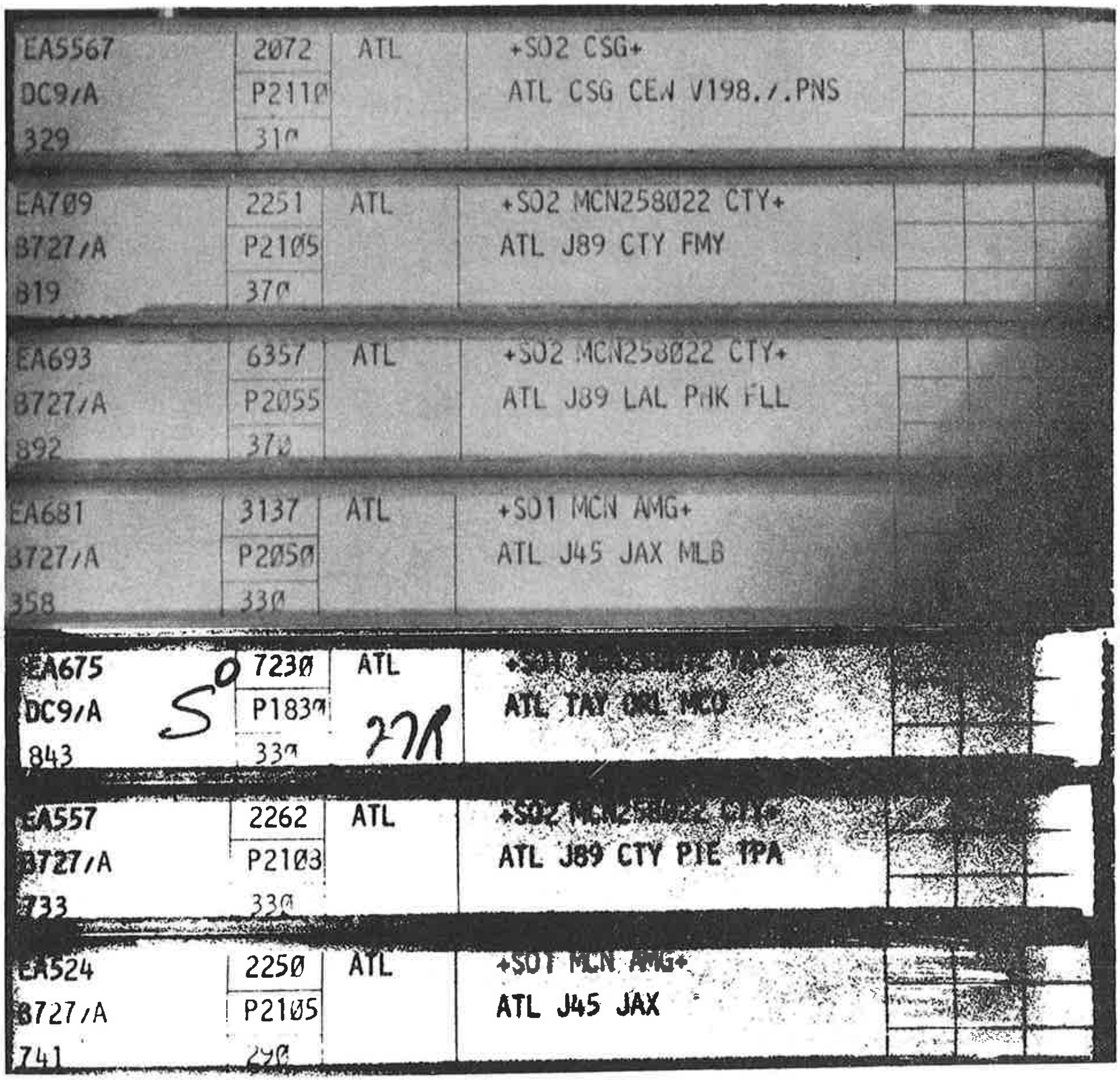
TRAY B (TOP)

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)

DL528 B727/A 673	2247 P2105 310	ATL	+NO2 TYS+ ATL J43 FLM CVG
DL429 B727/A 862	2237 P2103 210	ATL	+EA2 CONNIØ90010 CAE+ ATL CAE ⊕CSEP
DL407 B727/A 231	2001 P1941 [illegible]	ATL 22R	+EA2 CONNIØ90010 AGS+ ATL AGS V18 CHS ⊕CSEP
DL341 B727/A 486	2256 P2107 290	ATL	+SO2 MCN258022 CTY+ ATL J39 CTY TPA
DL268 B727/A [illegible]	637Ø P2055 200	ATL	+NO1 [illegible] J89 SWAPP ENO+ ATL J89 [illegible] ⊕CSEP
DL254 B727/A [illegible]	2225 P2190 330	ATL	+EA1 AHN SPA[illegible] ATL J37 GVE J37[illegible]
DL227 B727/A	2233 [illegible]	ATL	+SO2 MCN258022 CTY+ ATL J39 LAL LEILA MIA
DL126 B727/A	[illegible] [illegible]	ATL	+NO2 TYS+ ATL J43 FLM DAY./.DTW
DL122 [illegible]	[illegible] [illegible]	ATL 22R	+EA1 AHN SPA+ ATL J37 GVE J37./.JFK
[illegible] [illegible]	[illegible] P2117	ATL	+SO1 MCN SAV+ ATL SAV

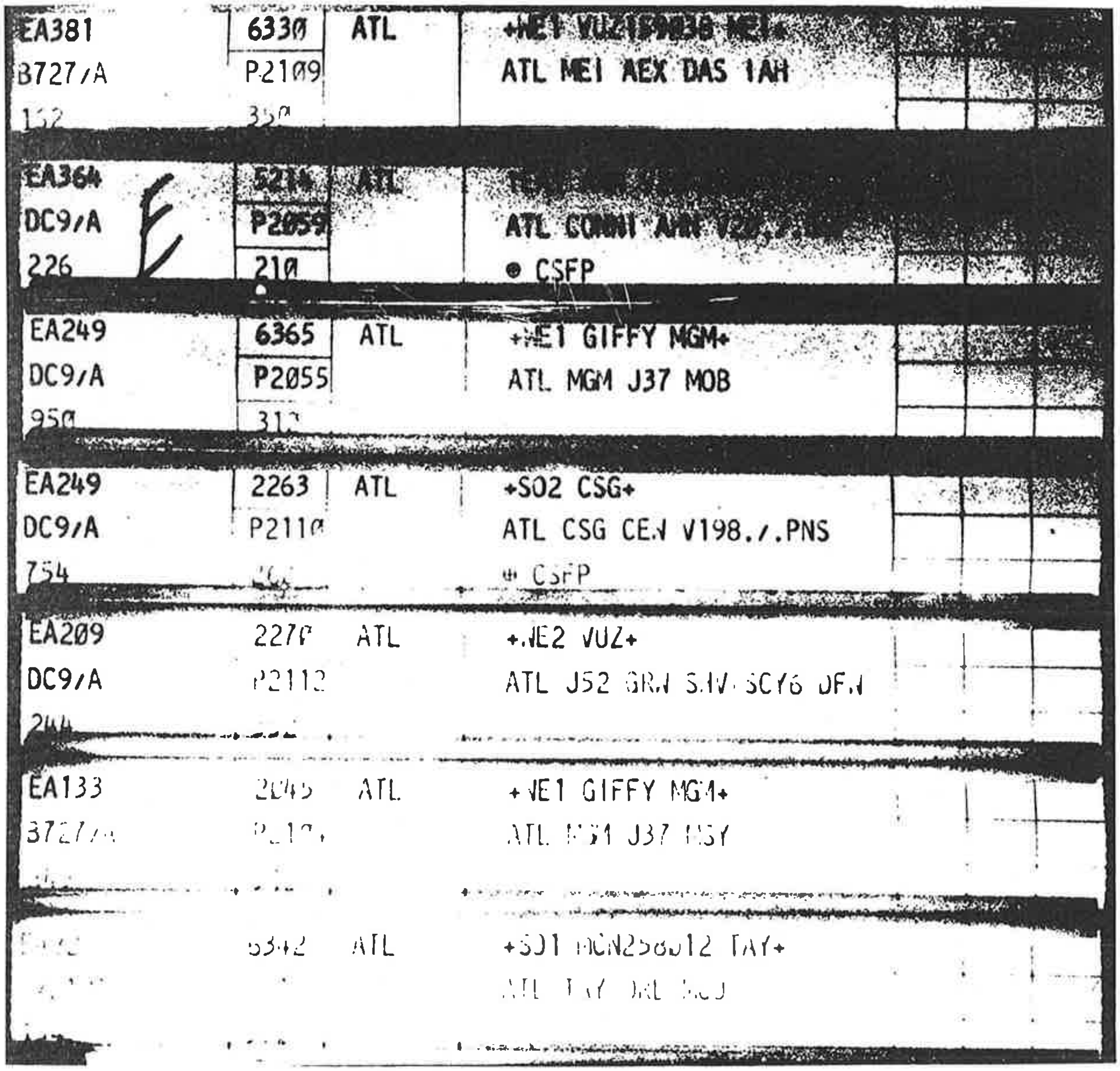
TRAY B (BOTTOM)

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)



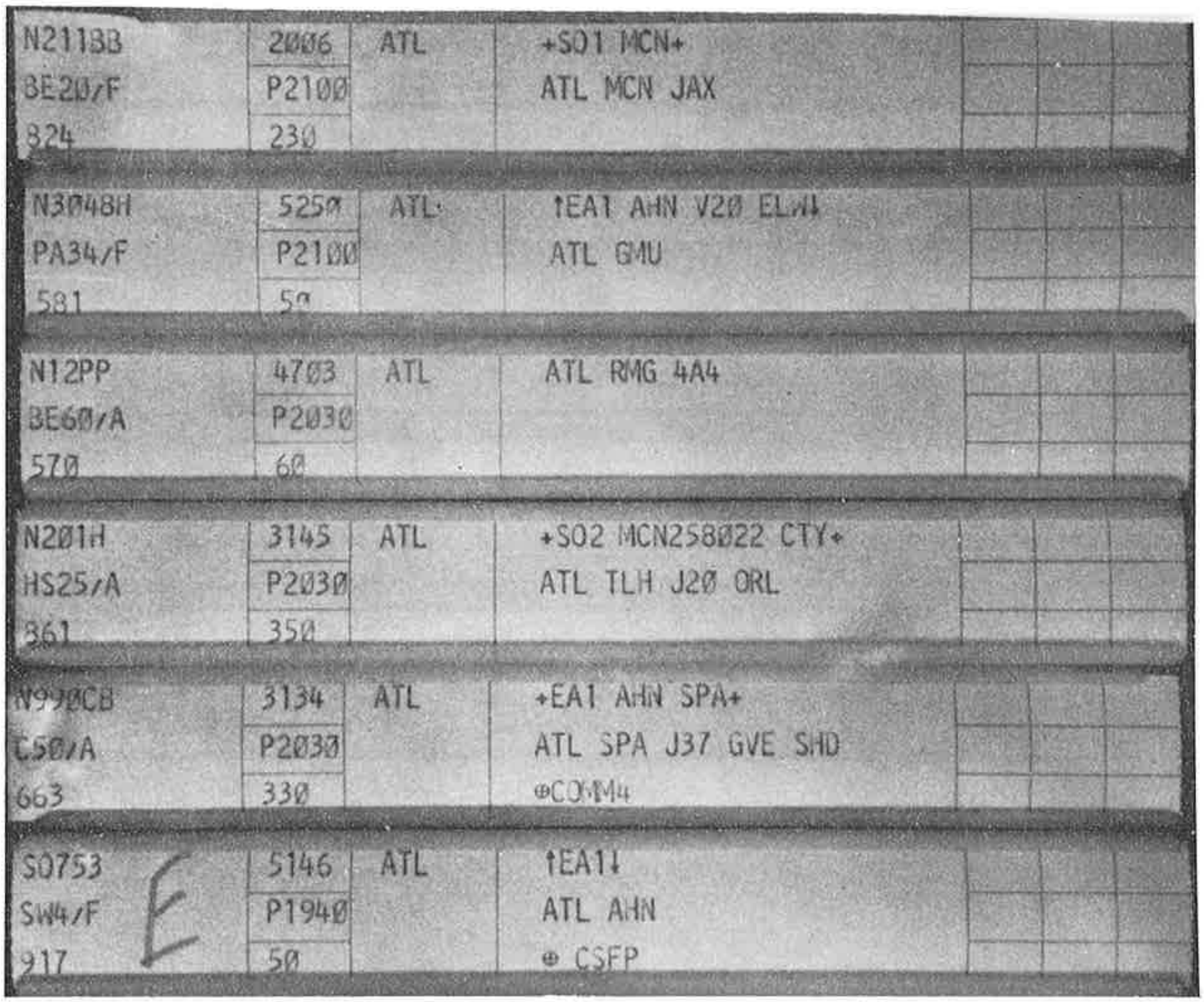
TRAY C TOP

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)



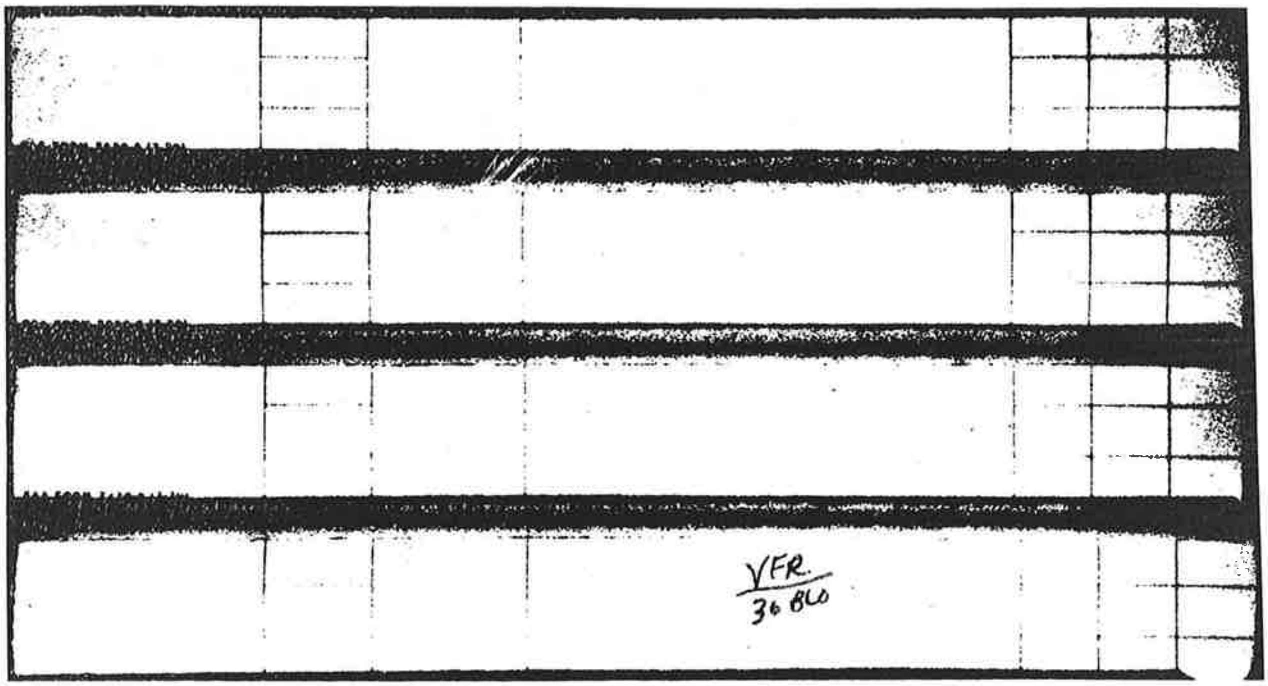
TRAY C (BOTTOM)

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)



TRAY D

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)



TRAY E

FIGURE 4-16. EXAMPLE CD FLIGHT DATA SETUP (CONT'D)

- Emphasizing certain flight plan information such as:
  - The departure vector area (e.g., E)
  - An unusual altitude request
  - A tower en route controlled flight
- Noting certain information to be used in handling a flight such as:
  - Runway assignment
  - Weight restrictions relative to the departure runway assignment
  - Location, if departure will be at an unusual location when pilot makes initial contact with Ground Control
- Noting when clearances are transmitted to the departures by means of a check mark.

When the pilot calls in for his clearance, the CD will read as much of the flight plan to the pilot as required. CD will then note that clearance was issued by means of a check mark and will put the flight strip into one of two handoff trays. The tray to the left of CD is used for strips being handed off to GC-2 and the tray to the right of CD for strips to GC-3, Figure 4-1.

When a pilot calls in for departure clearance but a printed flight strip is not on hand either because the pilot had not prefiled an IFR flight plan or had prefiled but a flight strip was not available (e.g., printed flight strip torn), CD will make out a handwritten strip for the flight. Figure 4-12 shows an example handwritten flight strip. From Table 4-3, it is seen that for an example weekday, there were 850 departures from Hartsfield-Atlanta and only 41 required handwritten flight strips.

4.4.1.2 Ground Control (GC) Positions

There are normally two Ground Control positions staffed at Atlanta, GC-2 and GC-3. However, during traffic peaks a third position may be staffed, GC-1. Their function is to service arrivals and departures between the airline gates and the runways. However, the airline companies control the traffic in the terminal ramp area and Local Control controls the traffic between runways 9R/27L and 9L/27R, Figure 2-3. Between these two sides of the airport the Ground Control positions divide the traffic as follows:

- o GC-2 services arrivals/departures to/from the east side of the terminal
- o CG-3 services arrivals/departures to/from the west side of of the terminal
- o GC-1 when staffed, handles all arrivals that are south of Runway 8/26

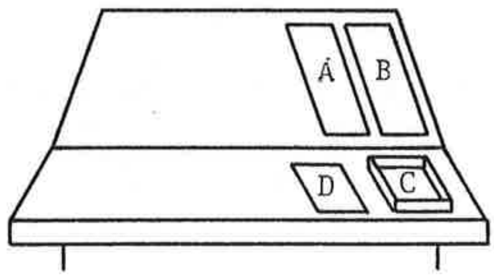
The layout of the flight data at the GC-2 and GC-3 positions are shown in Figures 4-17 and 4-18 respectively. At both positions, the flight strips are arranged as follows:

Trays A/B - Hold all departure flight strips prior to initial contact by the pilots and the flight strips are arranged by the numerical order of their flight numbers

Tray C - Holds all departure flight strips of flights under active ground control and the flight strips are arranged in the order that flights made initial contact (most recent contact is put on the bottom)

Each of the two ground controllers receive departure flight strips after their clearances have been issued. These strips are put into trays A and B until the pilots make initial contact. The strips tend to be in these trays for a matter of minutes. The ground controllers tend to use the strips in these trays to plan their future actions. In Figure 4-17, it is seen that GC-2 has changed the runway assignments on a number of strips from 26 to 27R. As a cue, controllers may cock those strips in the trays that will need special attention when initial contact is made by the pilots. In Figure 4-17, GC-2 has cocked those strips with runway reassignments, with weight restrictions and with questions concerning their assigned beacon codes.

On initial contact, the ground controller will take the corresponding flight strip from Trays A/B and put it into Tray C.



GC-2 POSITION SHOWING

TRAYS A&B

Two 13 Flight-Strip Console Mounted Trays

Number of Flight Strips in Sample-22 (30 is Typical Daily Maximum)

TRAY C

A Portable 10-Flight-Strip Tray

Number of Flight Strips in Sample-4 (10 is Typical Daily Maximum)

SCRATCH PAD D

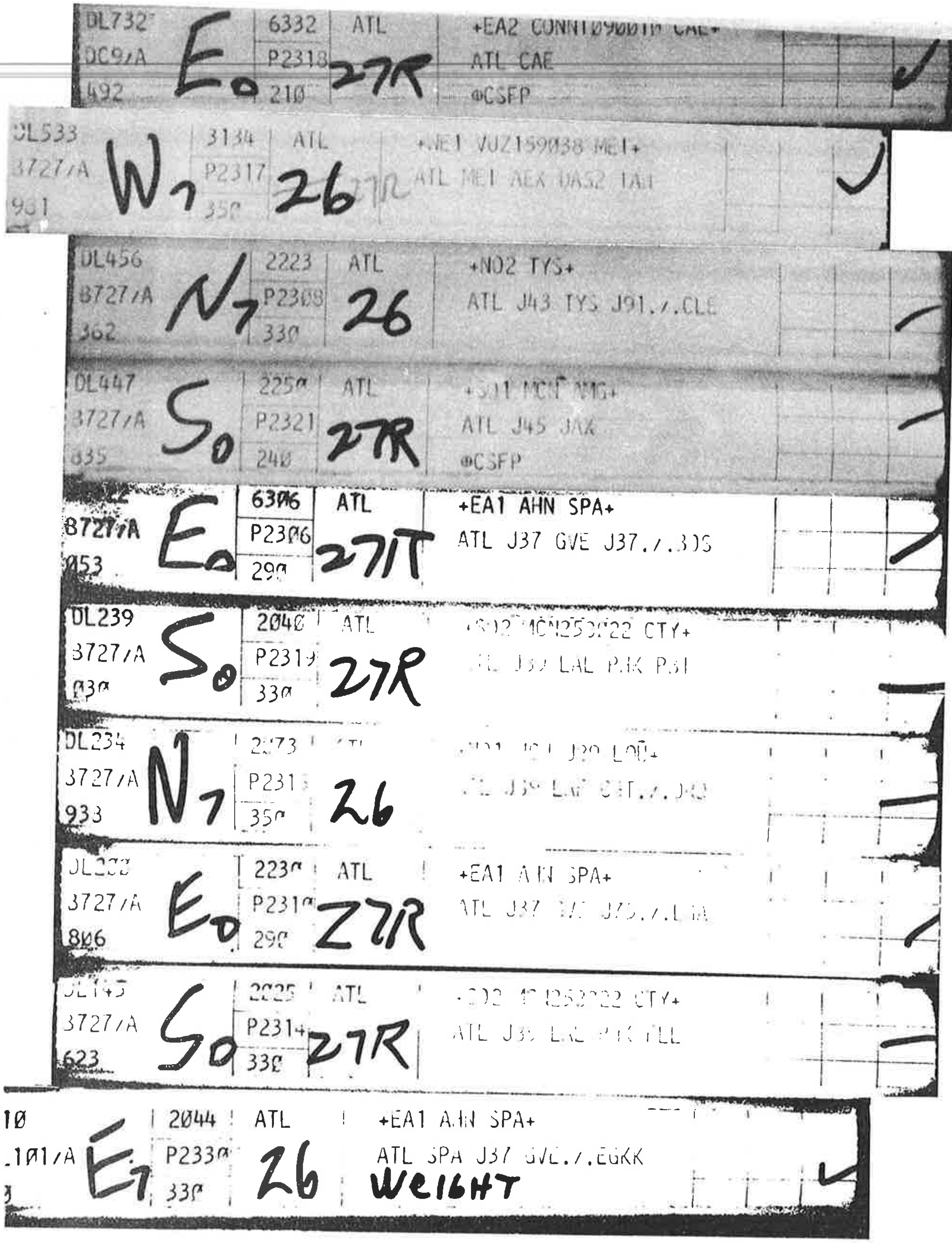
Number of Active Entries

South Side Arrivals-2 (6 is Typical DAily Maximum)

North Side Arrivals-1

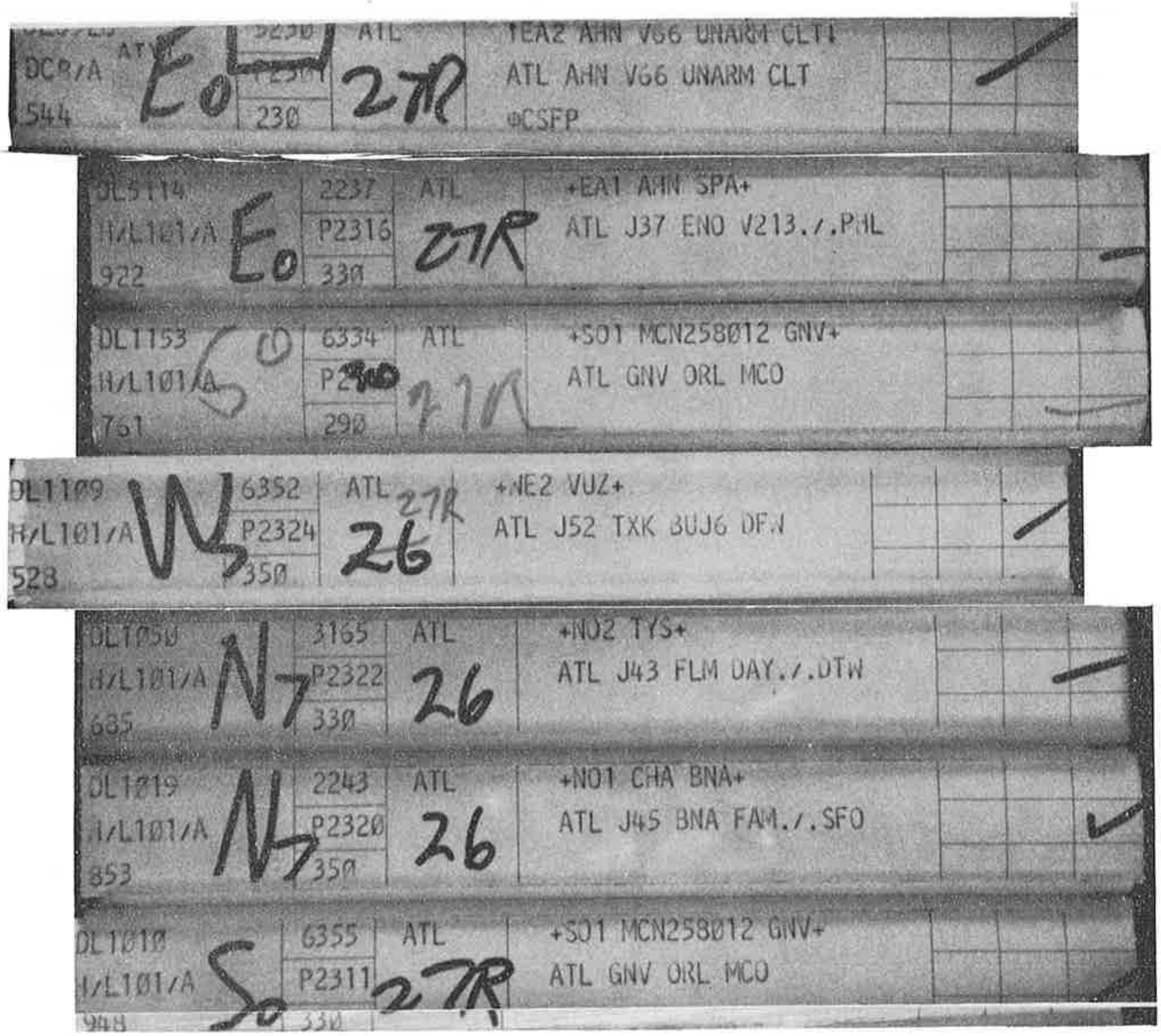
PHOTOGRAPHS TAKEN 2331 Z-TIME (6:31 LOCAL TIME)

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP



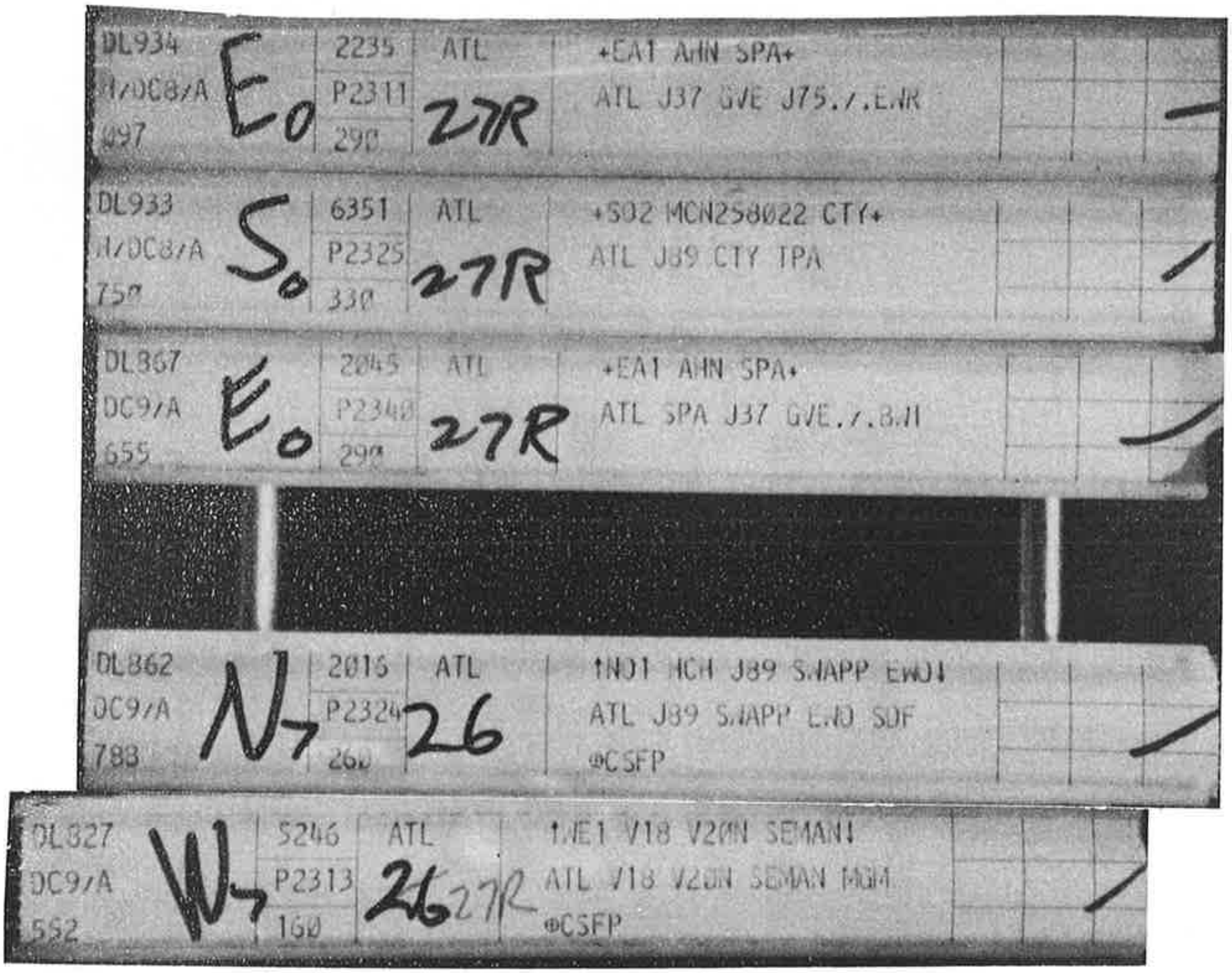
TRAY A

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP (CONT'D)



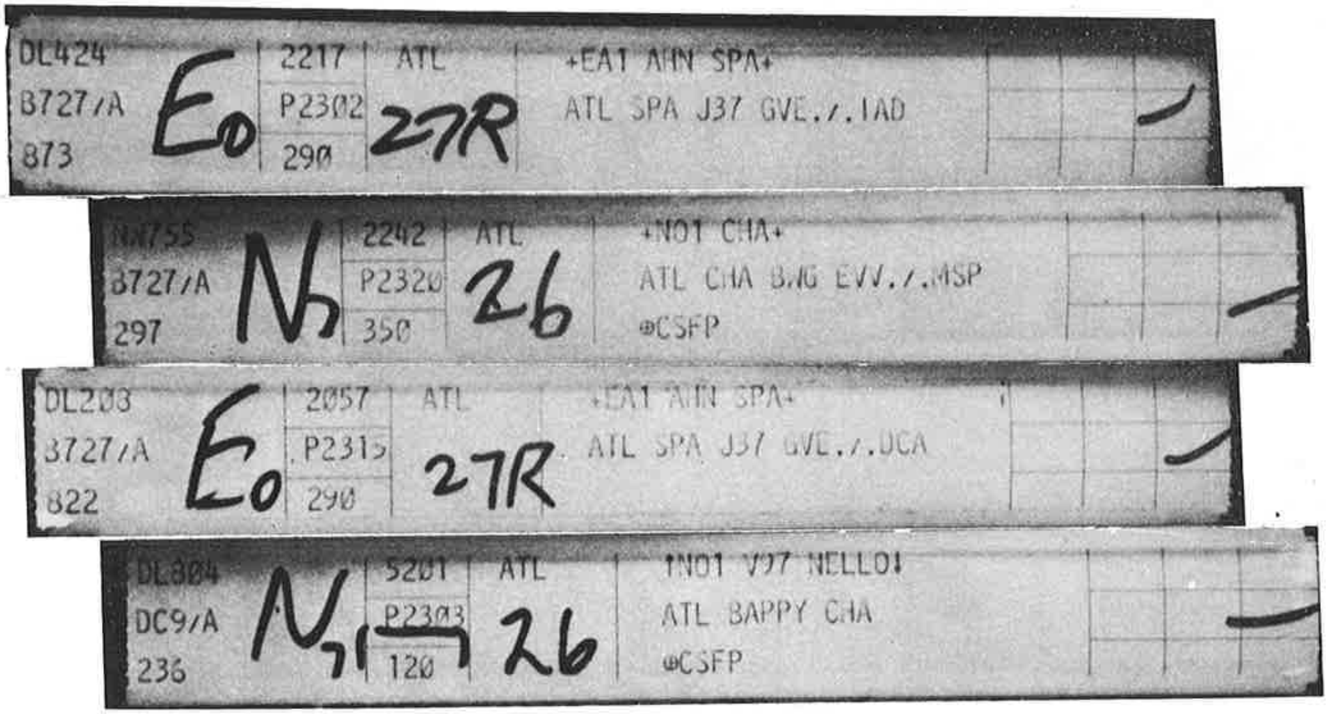
TRAY B (TOP)

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP (CONT'D)



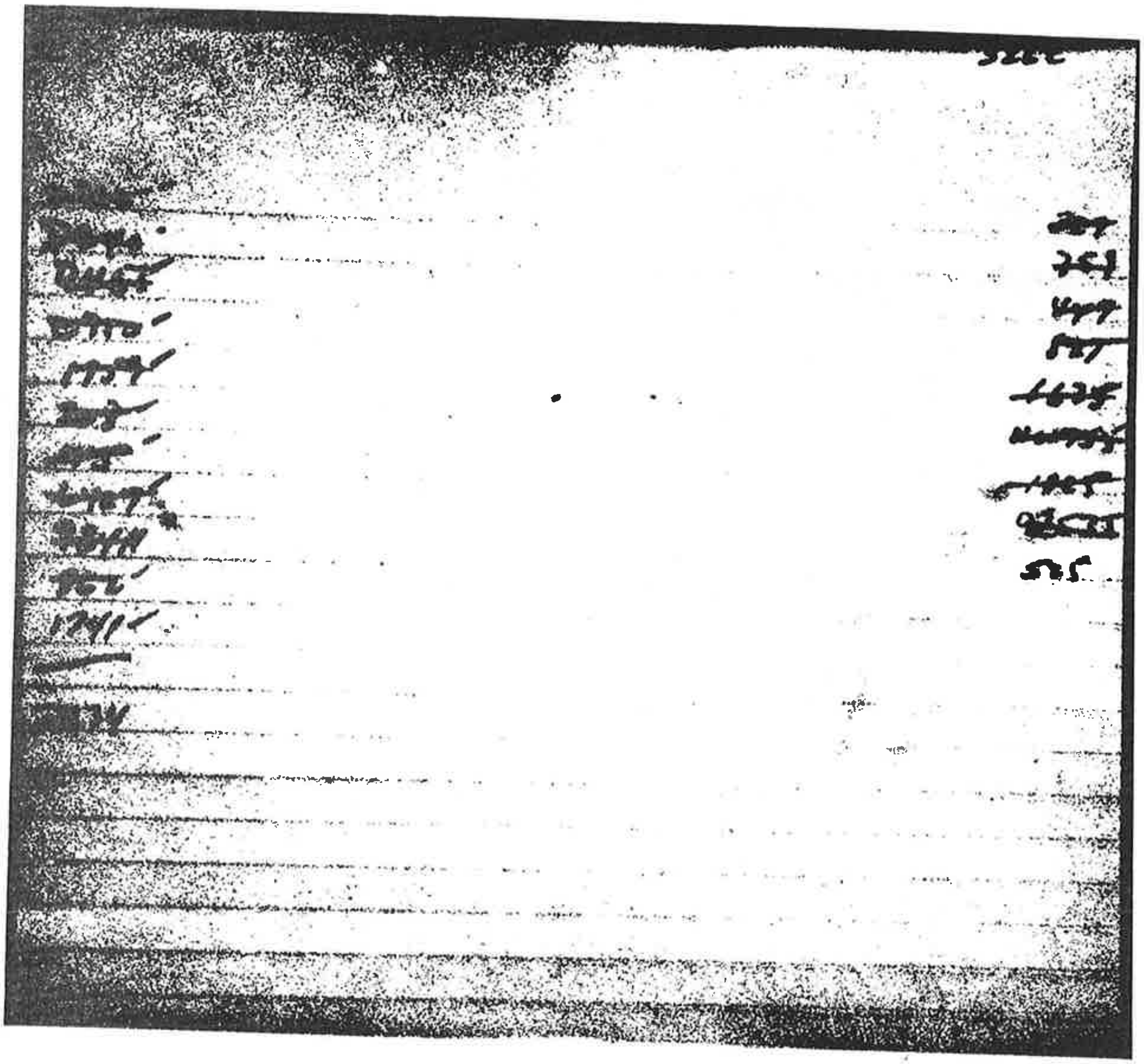
TRAY B (BOTTOM)

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP (CONT'D)



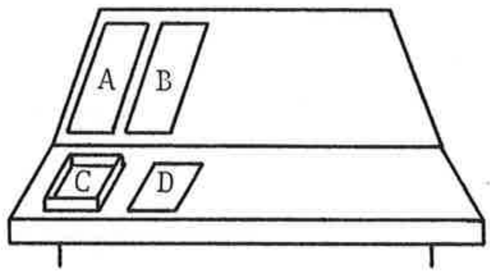
TRAY C

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP (CONT'D)



SCRATCHPAD D

FIGURE 4-17. EXAMPLE GC-2 FLIGHT DATA SETUP (CONT'D)



GC-3 POSITION SHOWING

TRAYS A&B

Two 13 Flight-Strip Console Mounted Trays

Number of Flight Strips in Sample-17 (25 is Typical Daily Maximum)

TRAY C

A 10-Flight-Strip Portable Tray

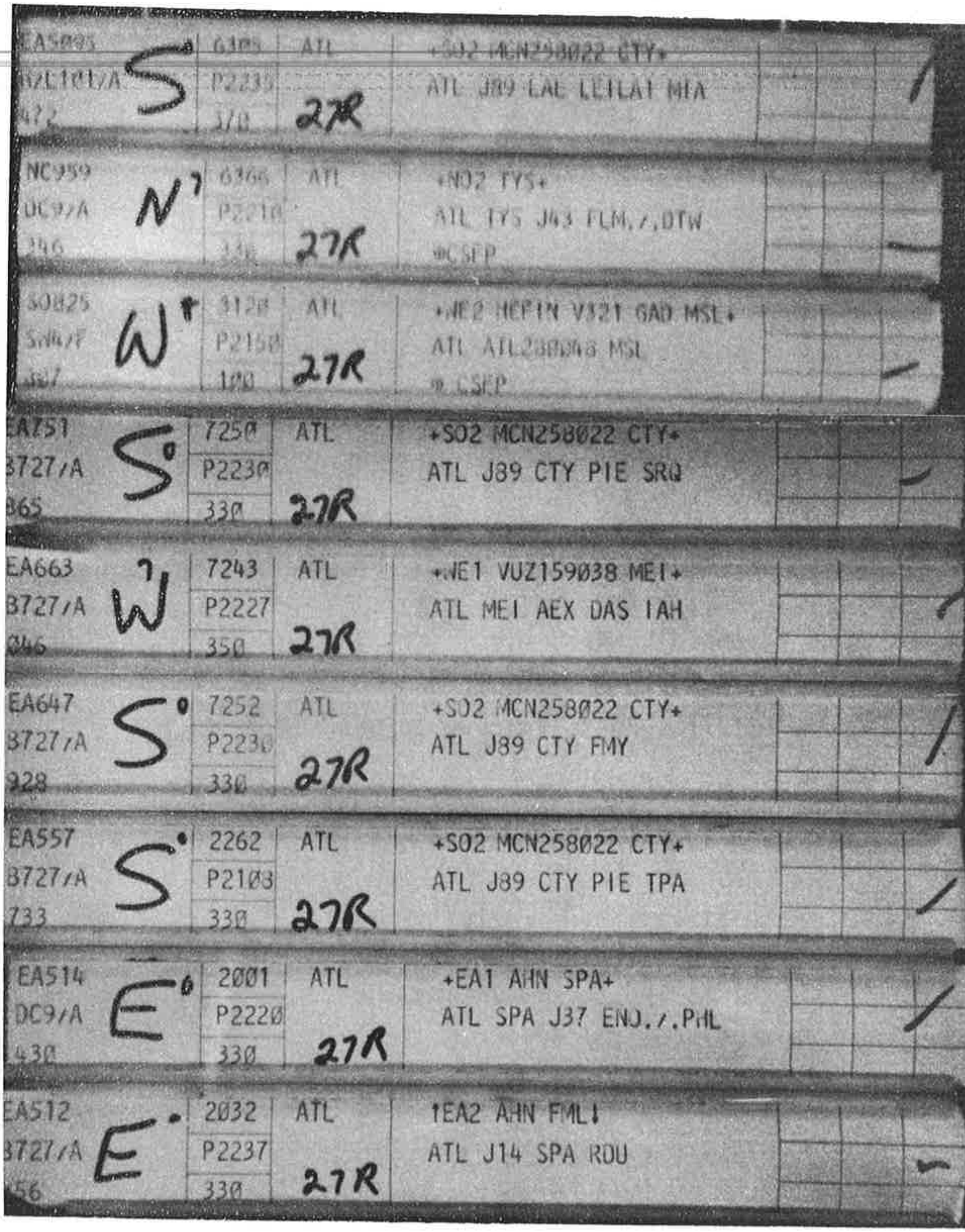
Number of Flight Strips in Sample-6 (12 is Typical Daily Maximum)

SCRATCHPAD D

Number of Active Entries in Sample-3 (6 is Typical Daily Maximum)

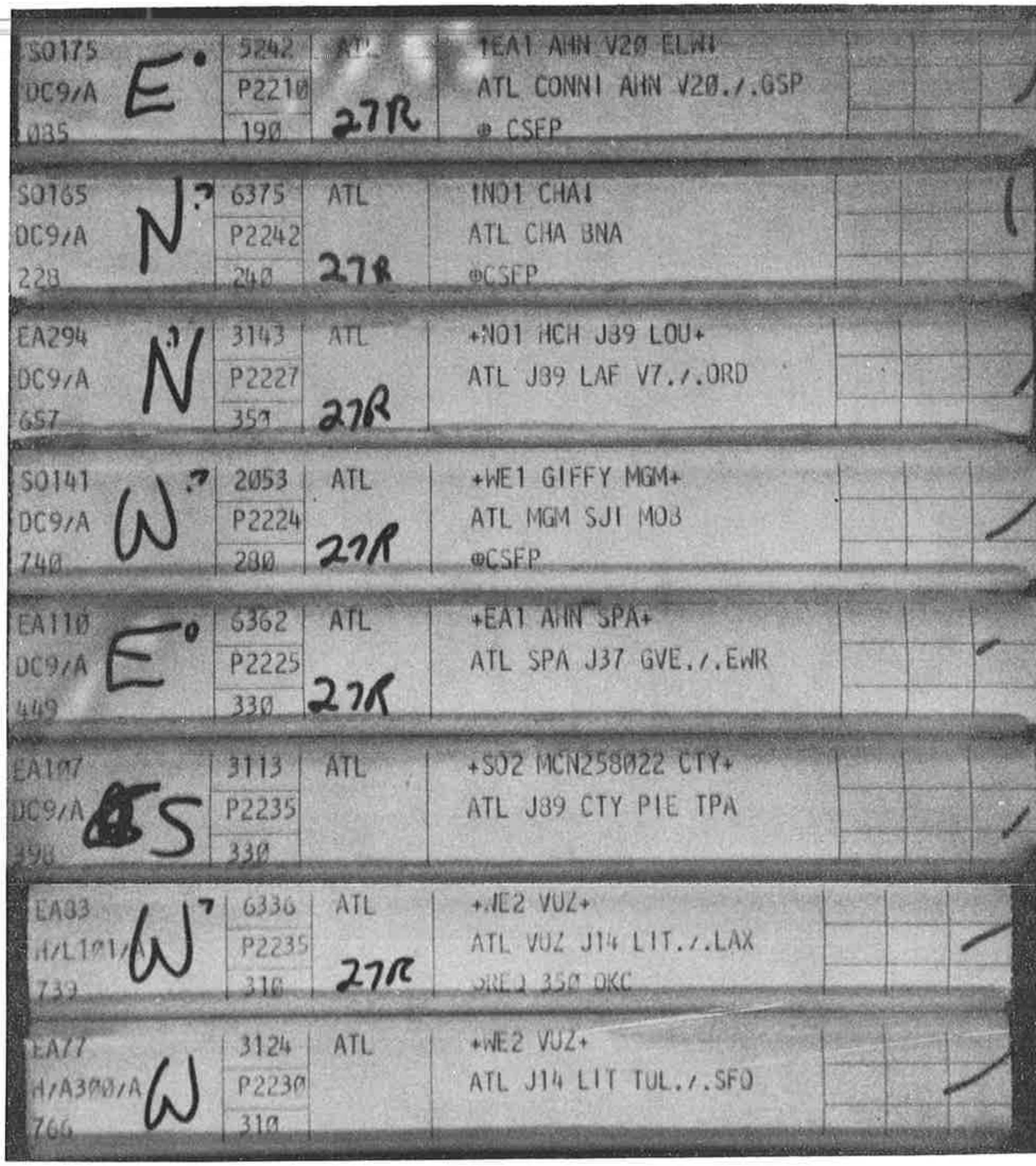
PHOTOGRAPHS TAKEN 2234 Z-TIME (5:34 PM LOCAL TIME)

FIGURE 4-18. EXAMPLE GC-3 FLIGHT DATA SETUP



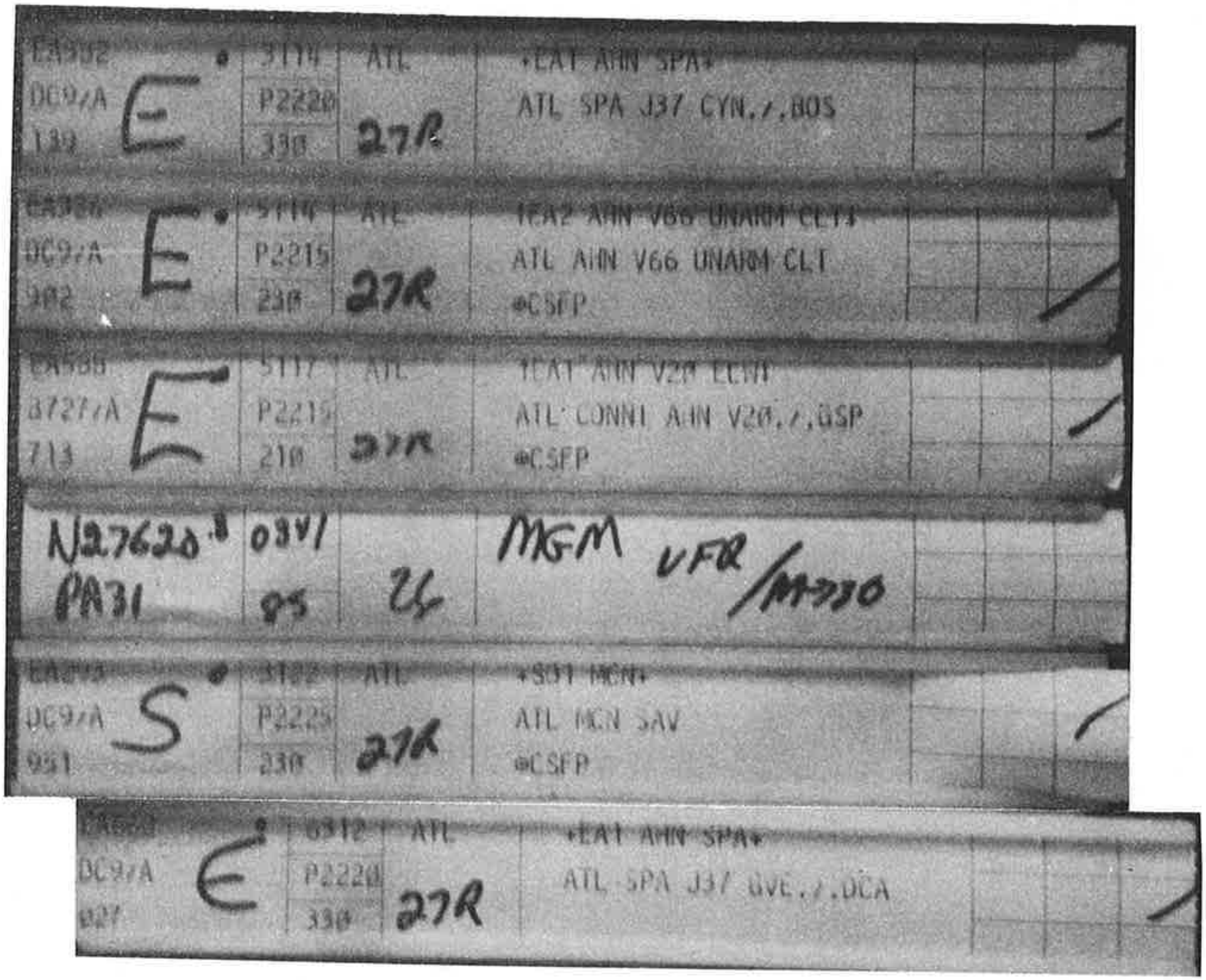
TRAY A

FIGURE 4-18. EXAMPLE GC-3 FLIGHT DATA SETUP (CONT'D)



TRAY B

FIGURE 4-18. EXAMPLE GC-3 FLIGHT DATA SETUP (CONT'D)



TRAY C

FIGURE 4-18. EXAMPLE GC-3 FLIGHT DATA SETUP (CONT'D)

~~S177~~

~~8C04~~

~~S112~~

~~X44C5~~

58Q

E950

E720

SCRATCH PAD D

FIGURE 4-18. EXAMPLE GC-3 FLIGHT DATA SETUP (CONT'D)

Flight strips are commonly cocked in Tray C to note their runway crossing status. The actual operation of this cue varies among the controllers. GC-2 in Figure 4-17 used the following scheme:

- o Strip cocked to left - pilot has been instructed to hold short of 8/26
- o Strip cocked to right - pilot has indicated that he is holding short of 8/26
- o Strip not cocked in tray - pilot has been cleared to his departure runway

Ground controllers rarely make marks on their departure flight strips.

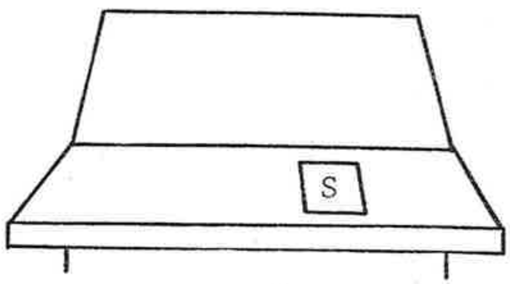
For arrivals, ground controllers do not have flight strips and use scratch pads. The ground controllers watch the ARTS BRITE displays in the tower cab and note the identities of the arrivals they will each handle on their scratch pads while the arrivals are still on final approach. GC-2 in Figure 4-17 has two lists of arrivals - one for arrivals on 8/26 and the other for arrivals on the southern set of runways. A check mark is made by the flight number as each pilot makes initial contact. The flight number is crossed out when the flight has been cleared to the terminal ramp area.

4.4.1.3 Local Control (LC) Positions - There are normally three Local Control positions staffed at Atlanta, LC-1, LC-2, and LC-3. Their functions are:

- o LC-1 services arrivals/departures on Runway 9R/27L, which is predominantly used as an arrival runway. LC-1 retains control of arrivals until they are clear of Runway 9L/27R
- o LC-2 services arrivals/departures on Runway 9L/27R, which is predominantly used as a departure runway
- o LC-3 services arrivals/departures on Runway 8/26, which is predominantly used as a mixed arrival/departure runway

The flight data layouts of the three Local Control positions are shown in Figure 4-19 for LC-1, Figure 4-20 for LC-2, and Figure 4-21 for LC-3. Departures are predominantly handled by LC-2 and LC-3. At both of these positions, flight strips are arranged in order of their takeoff sequence with the most recent strip on the bottom. Each of the two local controllers receive departure flight strips from Ground Control as the flights approach the departure runways. Typically, the local controller will cock the flight strip in the tray when the departure has been told to position and hold on the runway and to await takeoff clearance. In Figures 4-20 and 4-21, it is seen that both LC-2 and LC-3 have issued the position and hold instruction to their next departures. On issuing takeoff clearance, the local controller will note the time on the flight strip and drop the strip down the appropriate drop tube to the TRACON. There is a drop tube to the Departure Radar positions for departures climbing to the en route structure and a drop tube to the Satellite Radar positions for departures planning to leave the terminal area at lower altitudes. Out of the 850 departures from Hartsfield-Atlanta on the example weekday referred to in Table 4-3, 725 were handled by Departure Radar and 125 were handled by Satellite Radar.

All three local controllers use a scratch pad. Both arrival and departure lists are maintained by each local controller for his runway operation. For the approach list, each local controller notes the flight numbers of the arrivals to his runway as they appear on the ARTS BRITE display. Local controllers typically use a check mark by the flight number to note that the arrival has been granted clearance to land. The flight numbers are crossed out when they are handed off to Ground Control as they clear the runway. LC-1 is the exception to this procedure in that the arrivals are kept under control of LC-1 until they clear Runway 9L/27R. At that point, they are handed off to Ground Control and their flight numbers are crossed out on the LC-1 scratch pad. Arrival lists are maintained for two reasons. In the event of an ARTS failure, these lists are used for controller planning and communication purposes.

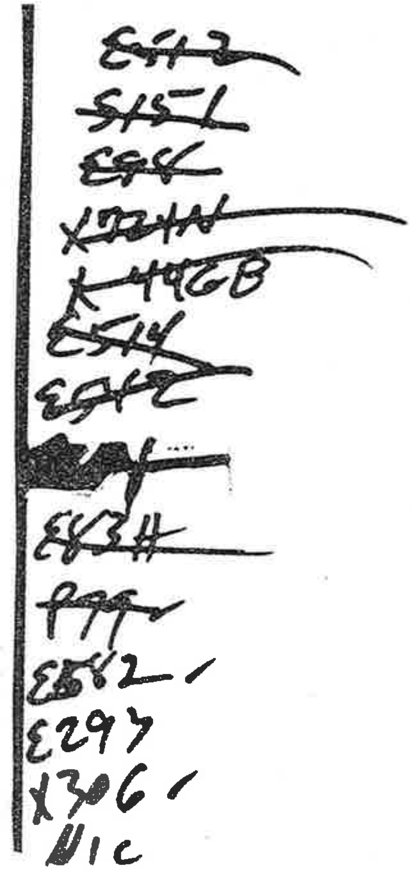


KEY FLIGHT DATA LOCATION

S SCRATCHPAD

PHOTOGRAPH TAKEN 2126 Z-TIME
(4:26 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT POSITION

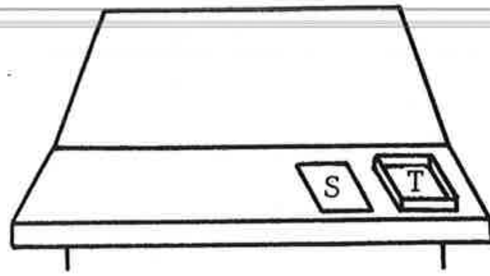


LIST OF ARRIVALS

NUMBER OF ACTIVE ENTRIES-4
(8 IS TYPICAL DAILY MAXIMUM)

SCRATCHPAD

FIGURE 4-19. EXAMPLE LC-1 FLIGHT DATA SETUP



LC POSITION SHOWING THE
SCRATCH PAD (s) AND PORTABLE
FLIGHT STRIP TRAY (T)

FLIGHT DATA LAYOUT AT POSITION

PHOTOGRAPHS TAKEN 2130 Z-TIME
(4:30 PM LOCAL TIME)

FIGURE 4-20. EXAMPLE LC-2 FLIGHT DATA SETUP

LIST OF ARRIVALS

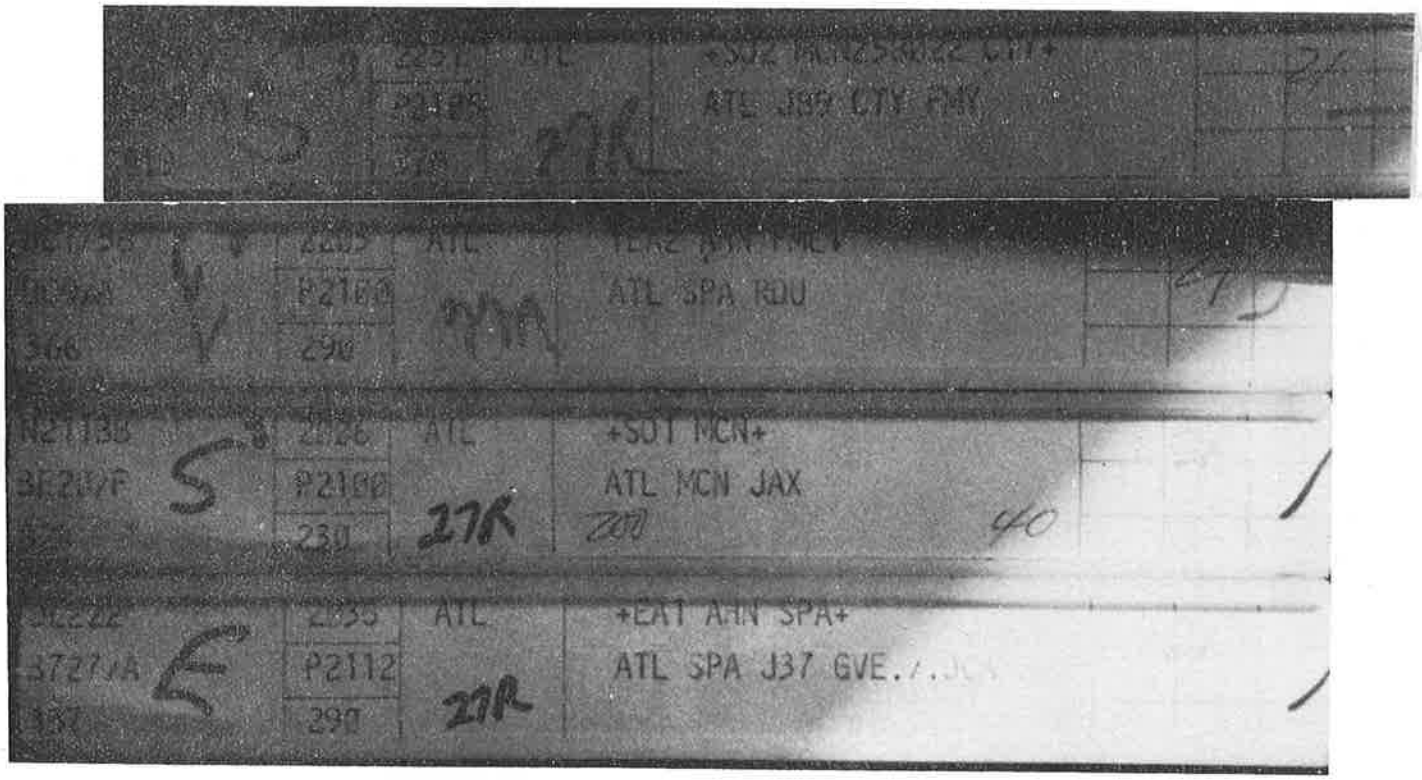
LIST OF DEPARTURES

NUMBER OF ACTIVE ENTRIES ARRIVAL LIST-0
(3 is the Typical Daily Maximum)

DEPARTURE LIST-6
(12 is the Typical Daily Maximum)

SCRATCHPAD

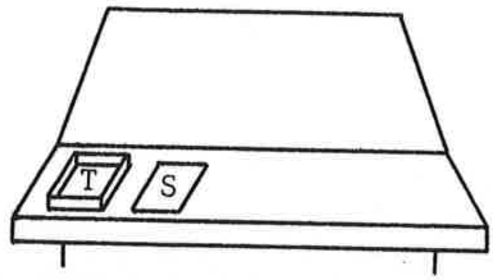
FIGURE 4-20. EXAMPLE LC-2 FLIGHT DATA SETUP (CONT'D)



NUMBER OF FLIGHT STRIPS-4
(15 is Typical Daily Maximum)

PORTABLE 10-FLIGHT-STRIP TRAY

FIGURE 4-20. EXAMPLE LC-2 FLIGHT DATA SETUP (CONT'D)



LC-3 POSITION SHOWING
THE SCRATCH PAD (s) AND
PROTABLE FLIGHT STRIP
TRAY (T)

PHOTOGRAPHS TAKEN 2122 Z-TIME
(4:22 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT
POSITION

FIGURE 4-21. EXAMPLE LC-3 FLIGHT DATA SETUP

~~25A~~
~~48A~~
~~S25T~~
~~D707~~
~~E669~~
~~E683~~
~~D606~~
SM 751

[redacted]
~~[illegible]~~
~~[illegible]~~
~~E167~~
~~E664~~
~~E299~~
~~KH137~~
~~D146~~
D107
E133
N727

LIST OF ARRIVALS

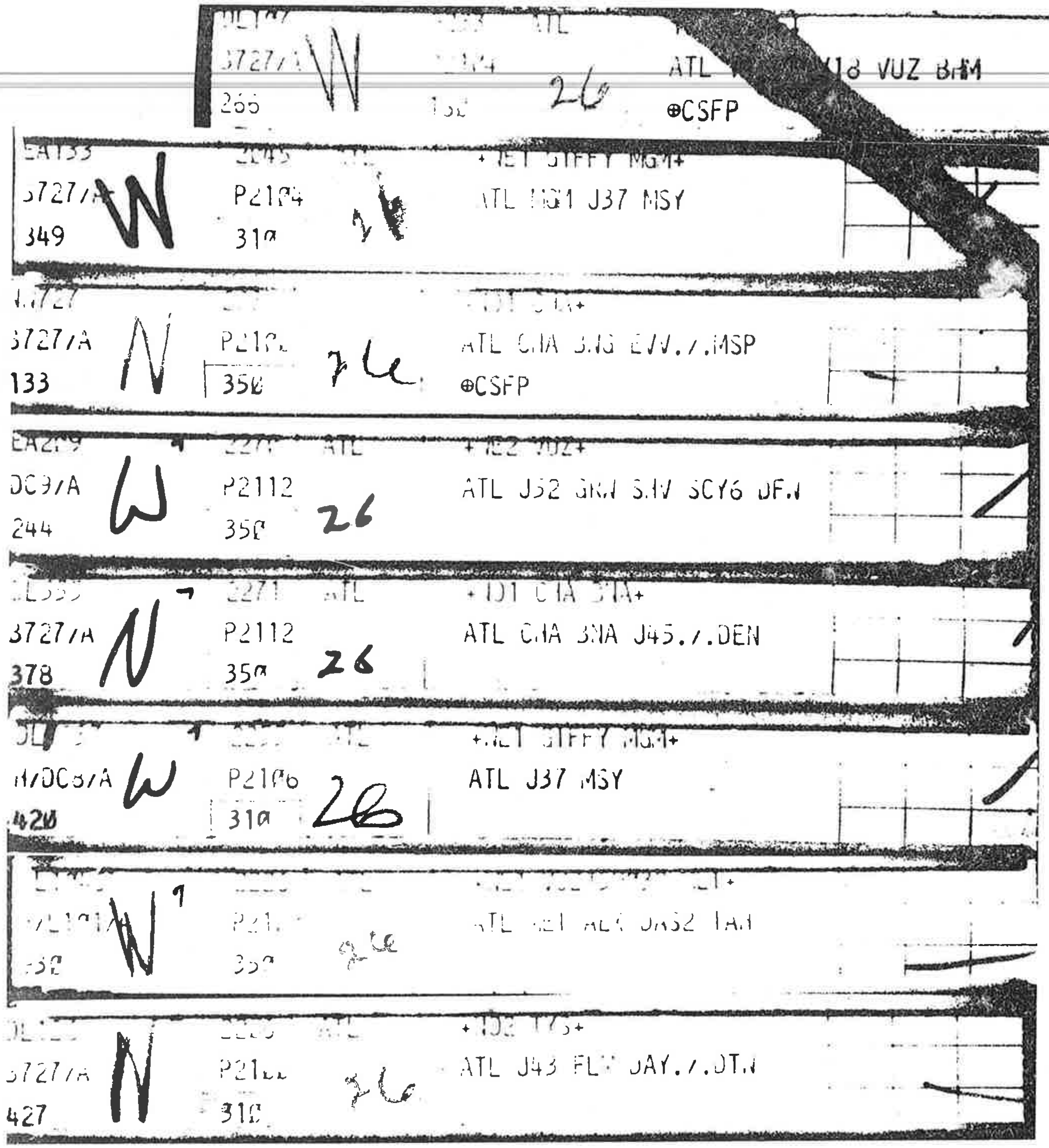
LIST OF DEPARTURES

NUMBER OF ACTIVE ENTRIES ARRIVAL LIST-1
(3 is Typical Daily Maximum)

DEPARTURE LIST-3
(12 is Typical Daily Maximum)

SCRATCHPAD

FIGURE 4-21. EXAMPLE LC-3 FLIGHT DATA SETUP (CONT'D)



NUMBER OF FLIGHT STRIPS-8
(12 is Typical Daily Maximum)

PORTABLE 10 FLIGHT STRIP TRAY

FIGURE 4-21. EXAMPLE LC-3 FLIGHT DATA SETUP (CONT'D)

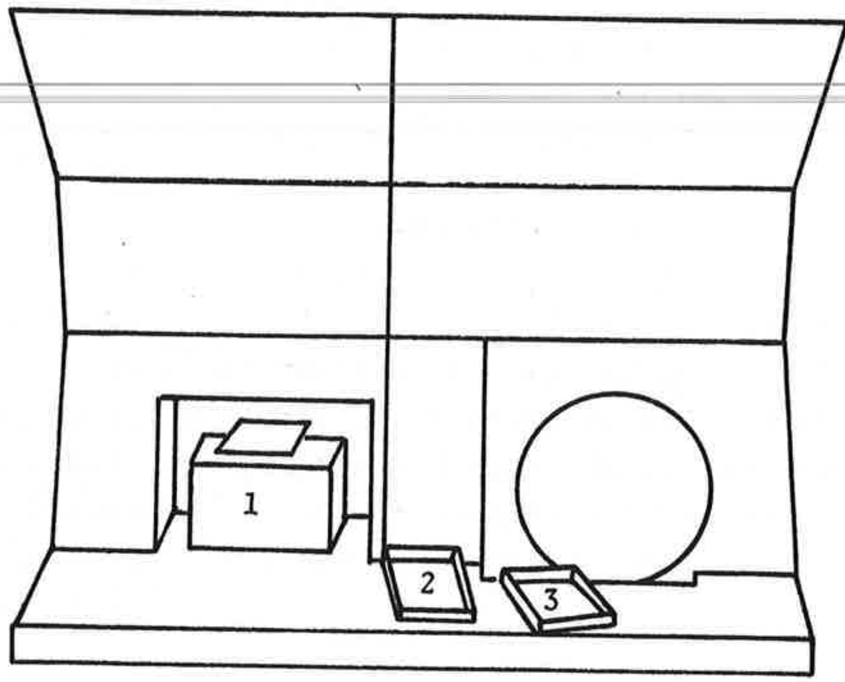
The second reason is that once these lists exist, they make convenient places for the controllers to note additional flight management data, such as landing clearance notifications.

Departure lists are also maintained by the local controllers on their scratch pads. The flight numbers in the list are copied directly from the flight strips in the trays. The reason for this dual listing is that the local controllers drop the flight strips down to the TRACON controllers when takeoff clearances are issued although the local controllers remain in radio contact with these departures for another two to three minutes. Typically, the local controllers will note when takeoff clearances have been issued by means of a check mark by the appropriate flight number on the scratch pad.

4.4.2 TRACON Positions

4.4.2.1 Terminal Arrival Radar (TAR) and Handoff (AH) Positions - The airport and the terminal airspace is split into a northside and a southside operation in the handling of arrivals to Hartsfield-Atlanta Airport. Figures 2-2 and 2-4 show the typical approach path patterns for this split arrival operation. TAR-2/AH-2 handle the northside operation and TAR-3/AH-3 handle the southside operation. The function of the TAR positions is to accept Hartsfield-Atlanta bound arrivals from the En Route Center at two fixes and to descend, slow, and merge these two streams of traffic to a single sequence before handoff to Final Control prior to turn on to the runway localizer. The primary duty of the AH positions is to keep current on the arrival operation so as to be able to assist their associated TAR positions. This assistance is in terms of taking TELCO calls (the inter-controller phone circuit), of performing ARTS keyboard functions, and of posting the incoming flight strips.

The flight data layouts for TAR-2/AH-2 and TAR-3/AH-3 are shown in Figures 4-22 and 4-23 respectively. The flight strips



ARRIVAL HANDOFF
(AH-2) POSITION

TERMINAL APPROACH
RADAR (TAR-2) POS.

KEY FLIGHT DATA LOCATIONS

1 FDEP PRINTER FOR ARRIVALS THROUGH NORTHERN APPROACH GATES DALAS AND LOGEN

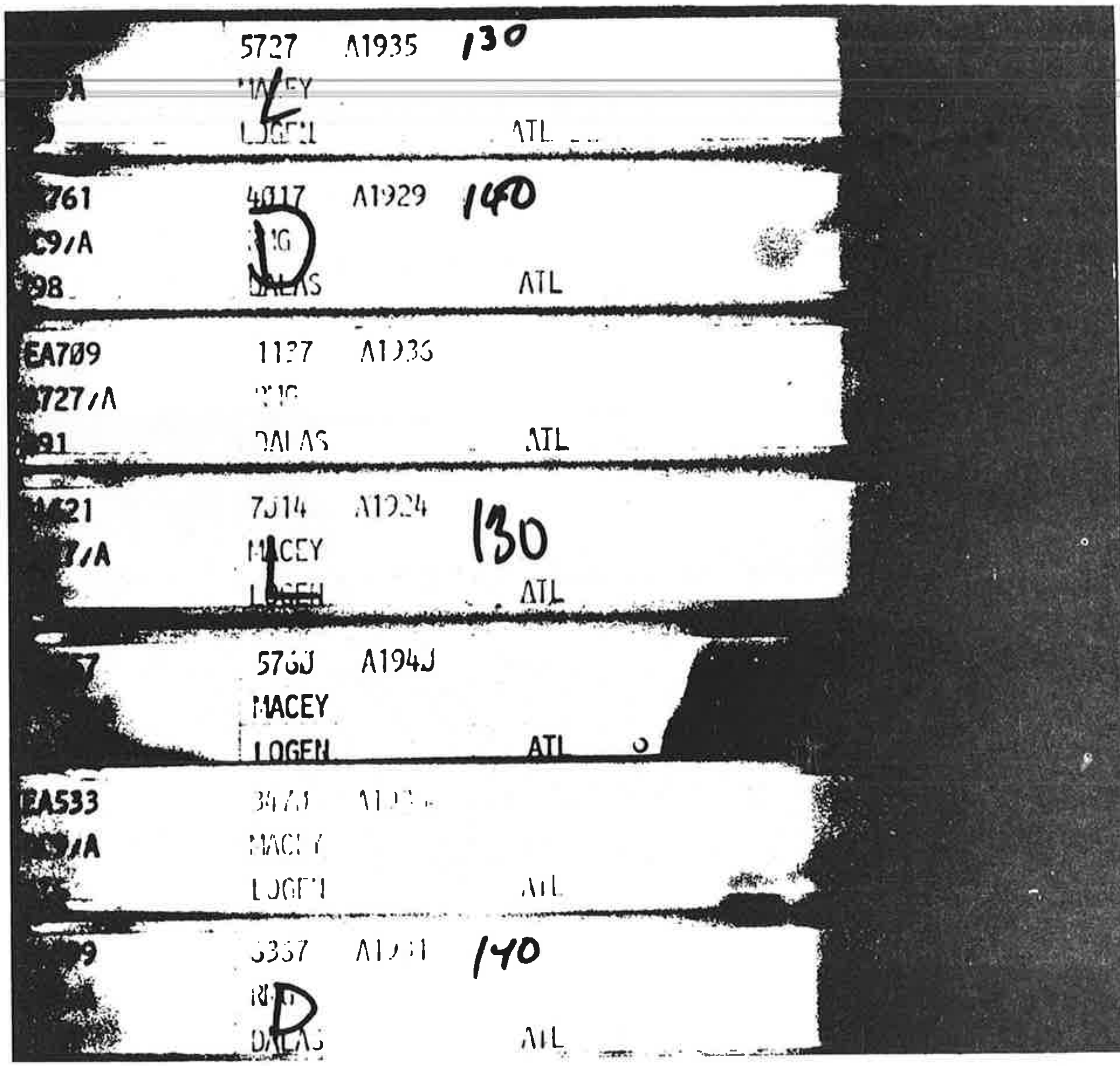
2 PORTABLE 15 FLIGHT-STRIP TRAY USED BY AH-2

3 PORTABLE 10 FLIGHT-STRIP TRAY USED BY TAR-2

PHOTOGRAPHS TAKEN 1910 Z-TIME
(2:10 PM LOCAL TIME)

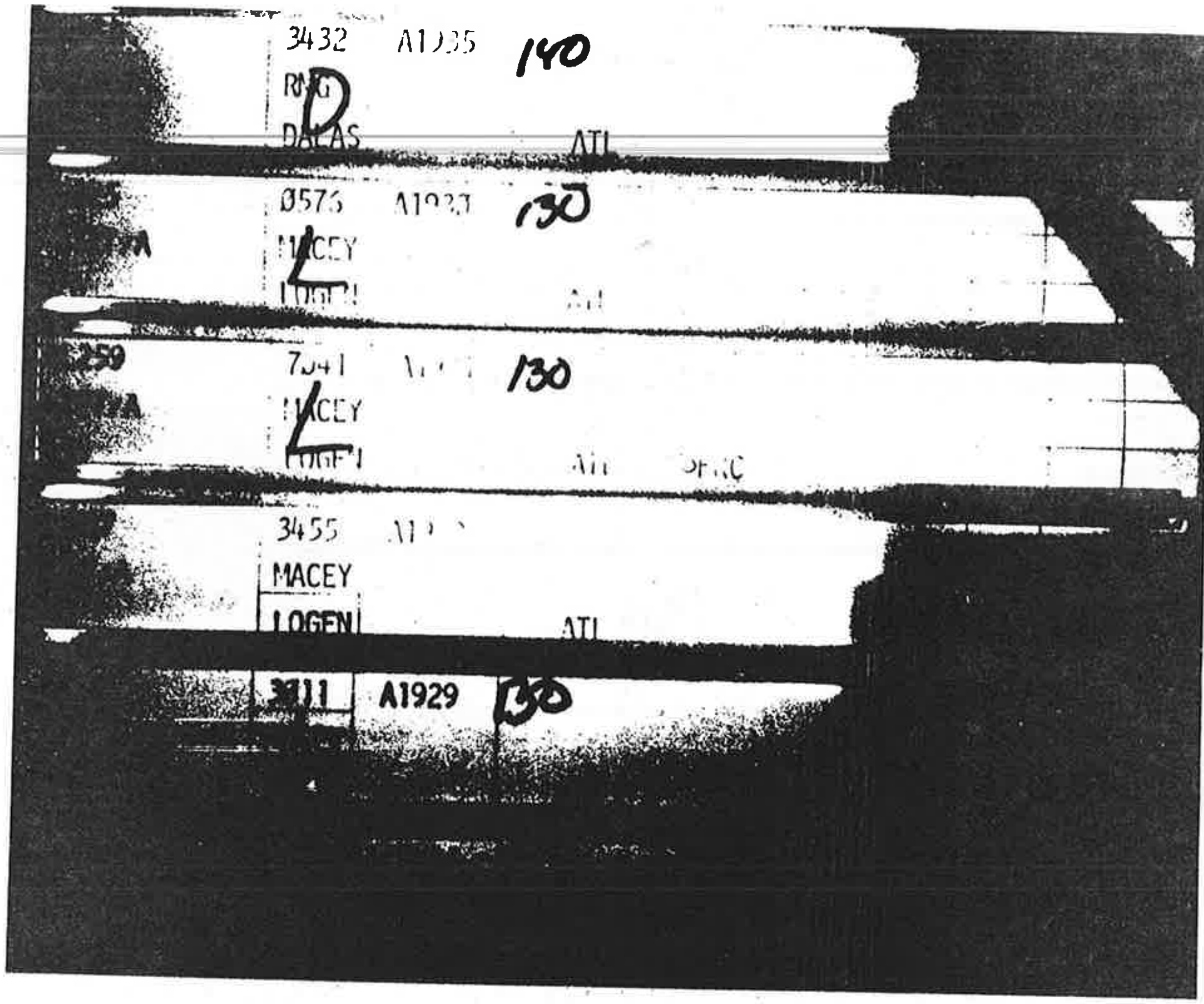
FLIGHT DATA LAYOUT AT THE AH-2/TAR-2 POSITIONS

FIGURE 4-22. EXAMPLE AH-2/TAR-2 FLIGHT DATA LAYOUT



AH-2 FLIGHT STRIP TRAY (TOP)

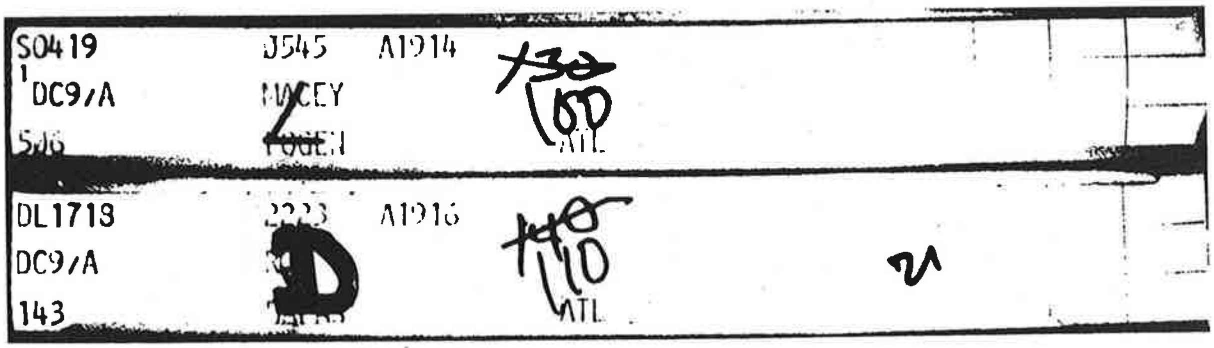
FIGURE 4-22. EXAMPLE AH-2/TAR-2 FLIGHT DATA LAYOUT (CONT'D)



NUMBER OF STRIPS IN TRAY 2-13
(15 IS TYPICAL DAILY MAXIMUM)

AH-2 FLIGHT STRIP TRAY (BOTTOM)

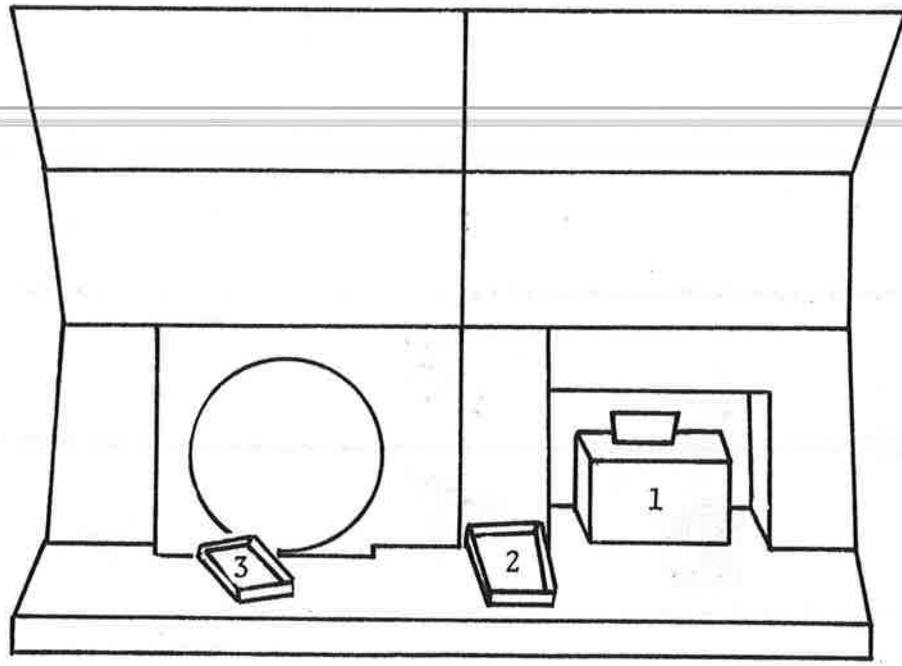
FIGURE 4-22. EXAMPLE AH-2/TAR-2 FLIGHT DATA LAYOUT (CONT'D)



NUMBER OF STRIPS IN TRAY 3-2
(10 IS TYPICAL DAILY MAXIMUM)

TAR-2 FLIGHT STRIP TRAY

FIGURE 4-22. EXAMPLE AH-2/TAR-2 FLIGHT DATA LAYOUT (CONT'D)



TERMINAL APPROACH
RADAR (TAR-3) POS.

ARRIVAL HANDOFF
(AH-3) POSITION

KEY FLIGHT DATA LOCATIONS

1 FDEP PRINTER FOR ARRIVALS THROUGH SOUTHERN APPROACH GATES TIROE AND HUSKY

2 PORTABLE 15 FLIGHT-STRIP-TRAY USED BY AH-3

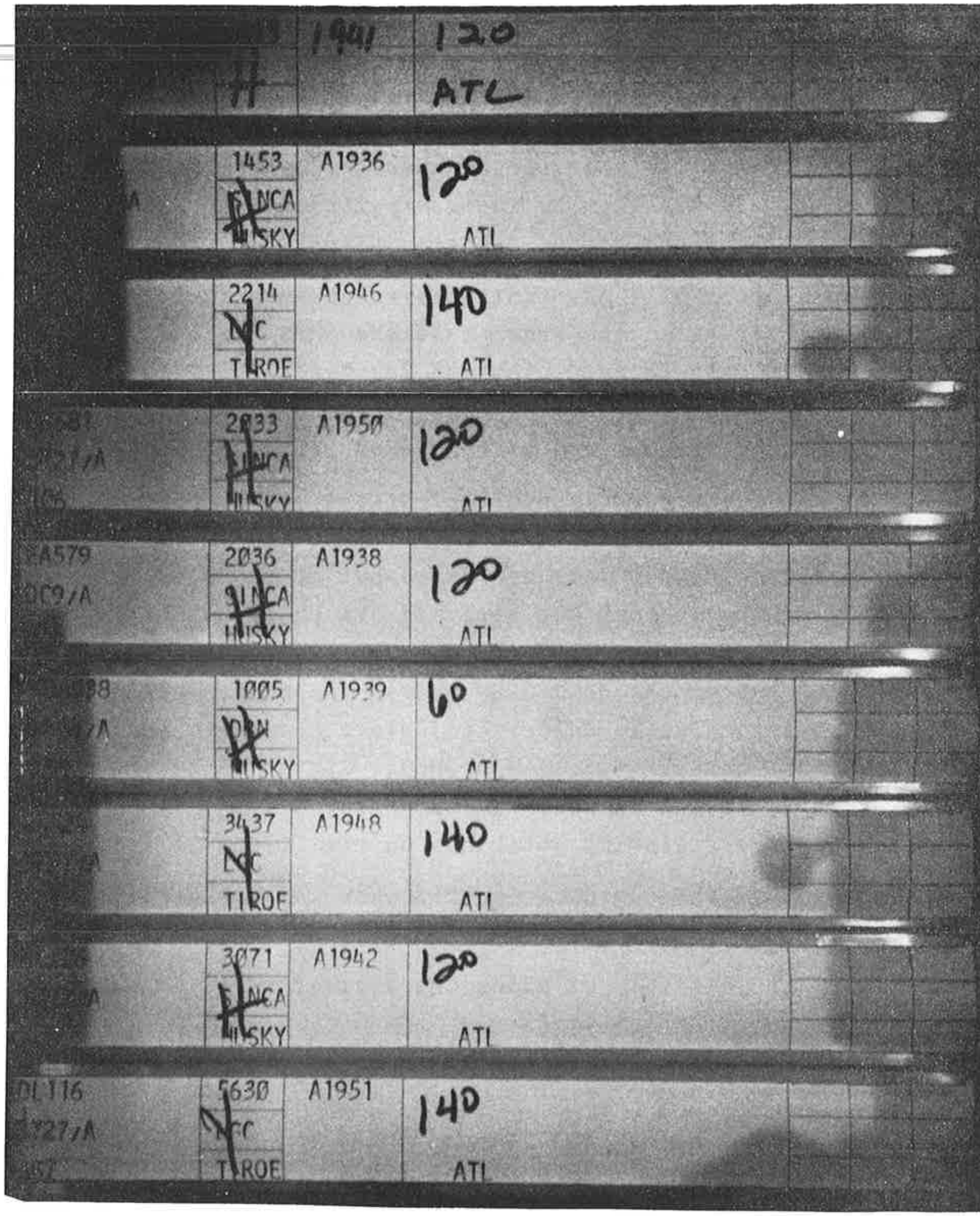
3 PORTABLE 10 FLIGHT-STRIP-TRAY USED BY TAR-3

AH-3 PHOTOGRAPH TAKEN 1920 Z-TIME
(2:20 PM LOCAL TIME)

TAR-3 PHOTOGRAPH TAKEN - MISSING

FLIGHT DATA LAYOUT AT THE
AH-3/TAR-3 POSITIONS

FIGURE 4-23. EXAMPLE AH-3/TAR-3 FLIGHT DATA LAYOUT



AH-3 FLIGHT-STRIP TRAY

NUMBER OF STIRPS-9
(15 IS TYPICAL DAILY MAXIMUM)

TAR-3 FLIGHT-STRIP TRAY (NA)

FIGURE 4-23. EXAMPLE AH-3/TAR-3 FLIGHT DATA LAYOUT (CONT'D)

are arranged in the trays in the following manner:

AH Trays - the most common arrangement used by controllers is to numerically sequence the flight strips by means of their flight numbers; other controllers sequence them by their expected times of arrival (ETA) at the Coordination Fixes

TAR Trays- About half the controllers sequence their flight strips in the order that the ARTS handoffs from the En Route Center are received; while the remaining controllers sequence the strips in the order the flights are to be handed off to Final Control

Each of the two arrival handoff positions has an FDEP unit at his position. Arrivals expected over the Logen and Dalas coordination fixes (Figure 2-2) are typed out on the AH-2 FDEP unit about 30 minutes before the arrivals are expected at the fixes. Similarly, arrivals expected over the Tiroe and Husky fixes are typed out on the AH-3 FDEP unit. The AH controllers put the strips into plastic holders and place them into their trays to await the ARTS handoff from the En Route Center which indicates when a particular flight is nearing its coordination fix. AH typically makes the following notations on the flight strips:

- Emphasizing the coordination fix over which the flight is to be expected
- Noting the altitude at which the arrival is to be expected at the coordination fix
- Noting if the arrival is to be a tower en route controlled flight
- Noting the time of the ARTS handoff of the arrival from the En Route Center

Some controllers also underline the initial altitude notation as a reminder when initial contact with the pilot has been made.

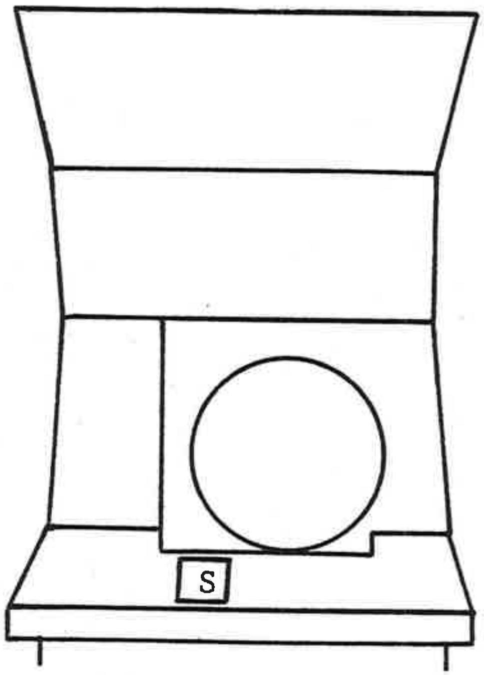
The TAR positions receive an arrival flight strip from the associated AH position when the ARTS handoff of the flight has been completed. TAR makes a number of notations on the flight strips which include:

- Noting altitude instructions issued to a flight and to a lesser extent speed and heading instructions
- Noting the arrival runway assignment if the assignment is not the usual one
- Noting if a pilot cancels the remainder of his IFR flight plan

For the few arrivals handled by the TAR positions that do not have filed IFR flight plans, handwritten flight strips are made up. Figure 4-11 shows a typical handwirtten flight strip for a Hartsfield-Atlanta arrival. The pilot would call the appropriate TAR position and either the TAR or AH would make out the strip for the flight. In the example weekday flight strip survey described in Table 4-3, only 34 of the total of 825 arrivals to Hartsfield-Atlanta that were handled by the TAR positions required handwritten flight strips.

4.4.2.2 Final Control (AR) Positions - There are two Final Control positions staffed at Atlanta, AR-1 and AR-2. The function of Final Control is to turn the arrivals to Hartsfield-Atlanta onto the localizers of that airport's two arrival runways. AR-1 handles arrivals to Runway 9R/27L, and AR-2 handles 8/26.

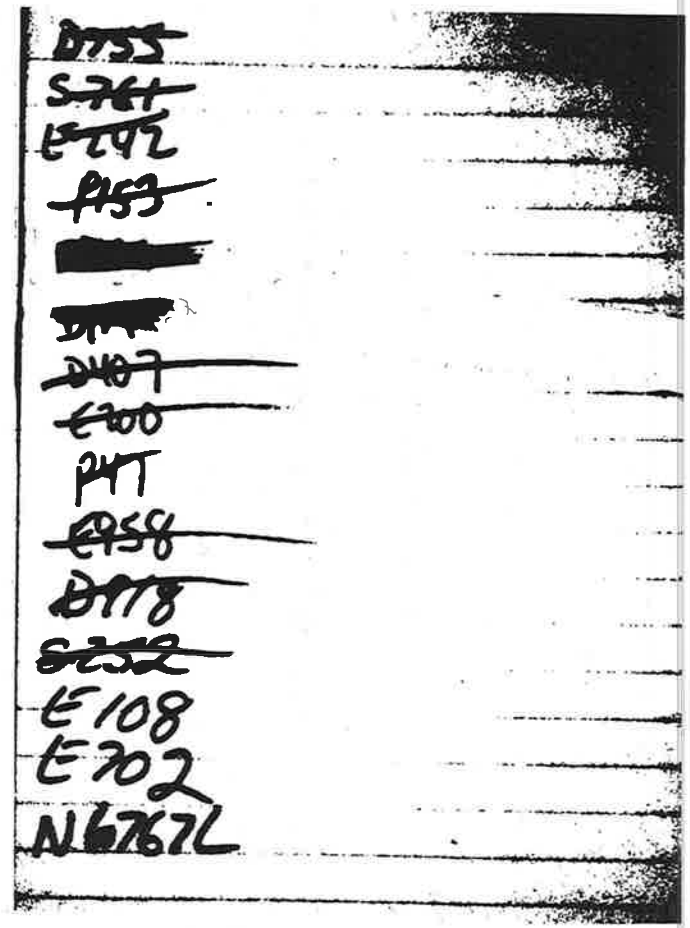
The flight data layouts for AR-1 and AR-2 are presented in Figures 4-24 and 4-25 respectively. Although flight strips are available for AR use, the AR positions use scratch pads in their place. This is due to the fact that the flight data requirements of Final Control are limited and can be satisfied directly from the information presented on the controller's Plan View Display (PVD). Final Control needs an arrival's flight number for communication purposes and aircraft type for determination of performance capabilities. Each arrival's data block displayed on the controller's PVD contains the arrival's flight number, altitude, speed, and aircraft type. Speed and aircraft type are displayed alternately in the data block at 3-second intervals. As was the case with



KEY FLIGHT DATA LOCATIONS
S SCRATCHPAD

PHOTOGRAPH TAKEN 1927 Z-TIME
(2:27 PM LOCAL TIME)

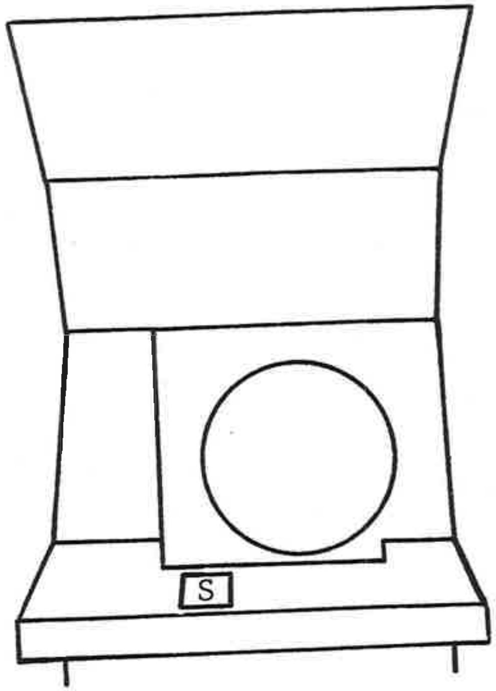
<u>FLIGHT DATA LAYOUT AT POSITION</u>



NUMBER OF ACTIVE ENTRIES-3
(5 IS TYPICAL DAILY MAXIMUM)

<u>SCRATCHPAD</u>

FIGURE 4-24. EXAMPLE AR-1 FLIGHT DATA LAYOUT



KEY FLIGHT DATA LOCATIONS
S SCRATCHPAD

PHOTOGRAPH TAKEN 1919 Z-TIME
(2:19 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT POSITION

NUMBER OF ACTIVE ENTRIES-2
(7 IS THE TYPICAL DAILY
MAXIMUM)

SCRATCHPAD

FIGURE 4-25. EXAMPLE AR-2 FLIGHT DATA LAYOUT

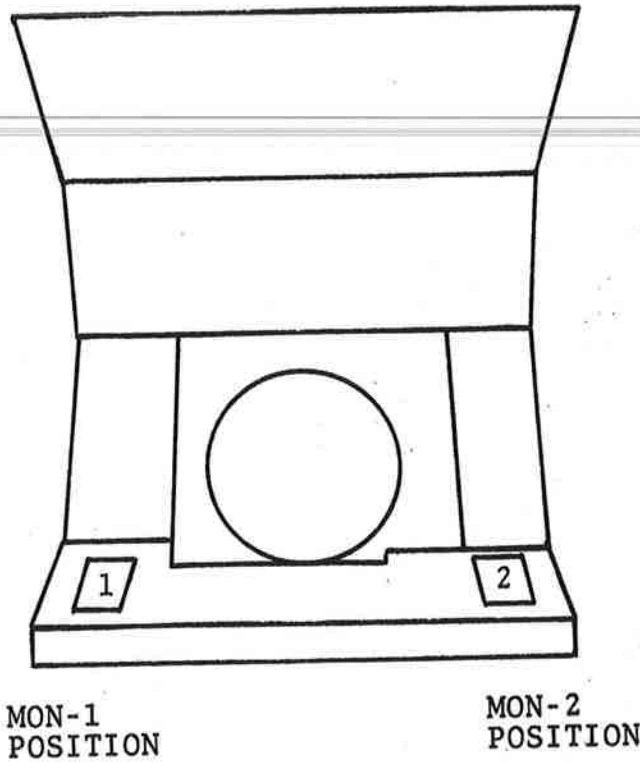
Local Control, the two AR controllers maintain the flight numbers of the arrivals under control as a backup to ARTS in the event of an ARTS/PVD failure.

4.4.2.3 Monitor (MON) Positions - The Monitor Positions are responsible for separation between the two parallel arrival streams of traffic to Hartsfield-Atlanta once the aircraft are on the localizer beams. These positions are staffed when the airport is operating under IFR versus VFR conditions. The arrivals to Runway 8/26 capture the localizer at an altitude 1000 ft. above that at which traffic to 9R/27L makes the localizer turn-on, Figure 2-2. The monitors maintain separation between the parallel traffic streams from the point at which the 1000 ft. vertical separation is lost until the aircraft are one mile from the end of the runway. Local Control assumes jurisdiction at that point. The monitors are on the Final Control frequencies and can issue separation instructions to the aircraft, but the aircraft remain the responsibility of the AR positions in all other matters. There are two Monitor positions staffed at Atlanta, MON-1 and MON-2. MON-1 is on the AR-1 frequency and MON-2 is on the AR-2 frequency.

The flight data layouts for MON-1 and MON-2 are shown in Figure 4-26. Both controllers share the same PVD. The flight data setup is the same as found for the AR positions described in the previous subsection. The monitors get their flight data directly from the PVD, and each maintains a list of flights under control in the event of an ARTS/PVD failure.

4.4.2.4 Departure Radar (DR) Positions - The Departure Radar positions perform the following functions:

- To service departures from Hartsfield-Atlanta from shortly after liftoff until they reach the departure gates located around the perimeter of the Terminal Area, Figure 2-1.
- To service IFR filed turbojet departures from satellite airports when a handoff is accepted from the Satellite Radar positions.



KEY FLIGHT DATA LOCATIONS

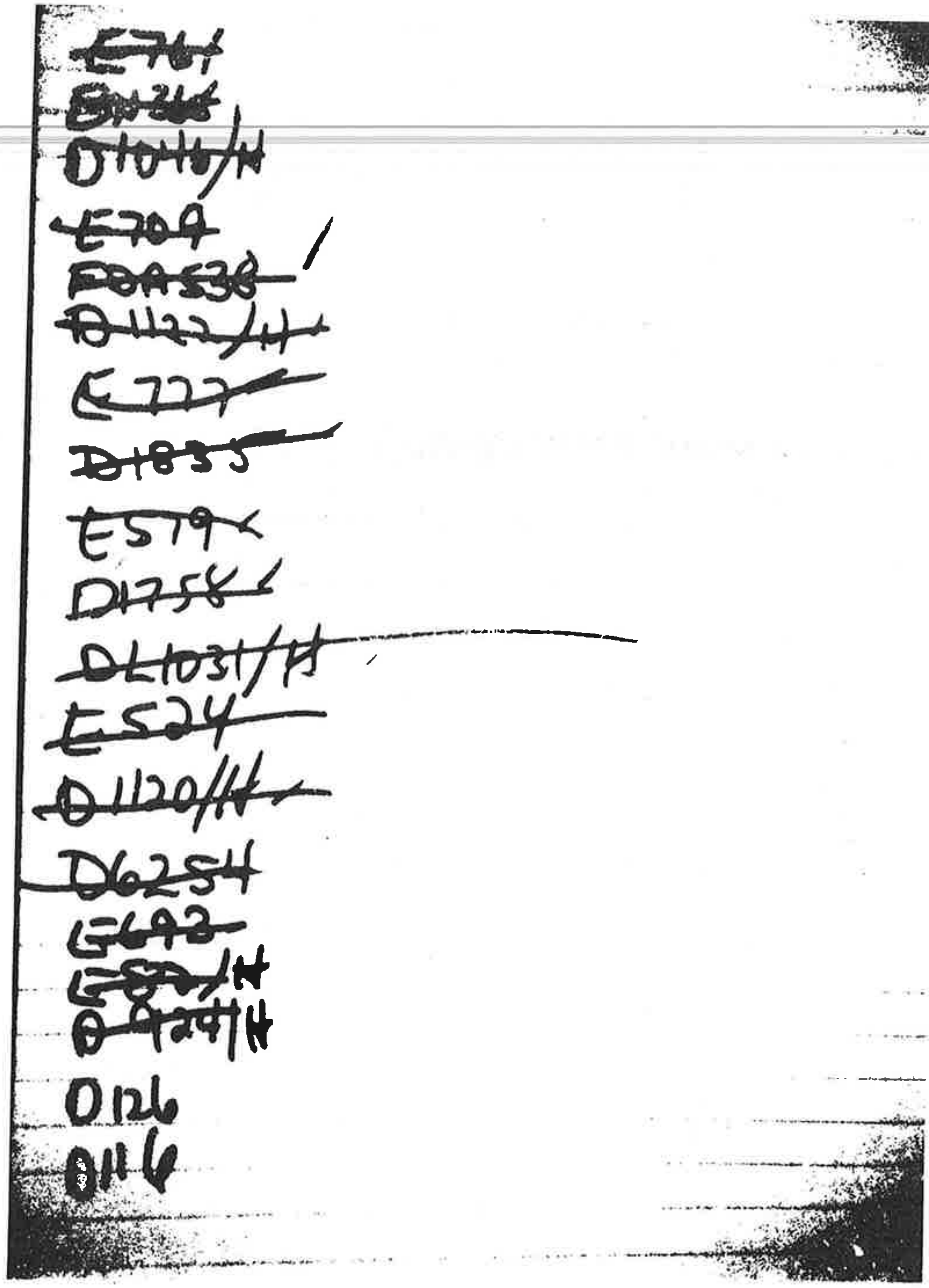
1 SCRATCHPAD USED BY MON-1

2 SCRATCHPAD USED BY MON-2

PHOTOGRAPHS TAKEN 2020 Z-TIME
(3:20 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT THE POSITIONS

FIGURE 4-26. EXAMPLE MON 1/2 FLIGHT DATA LAYOUT

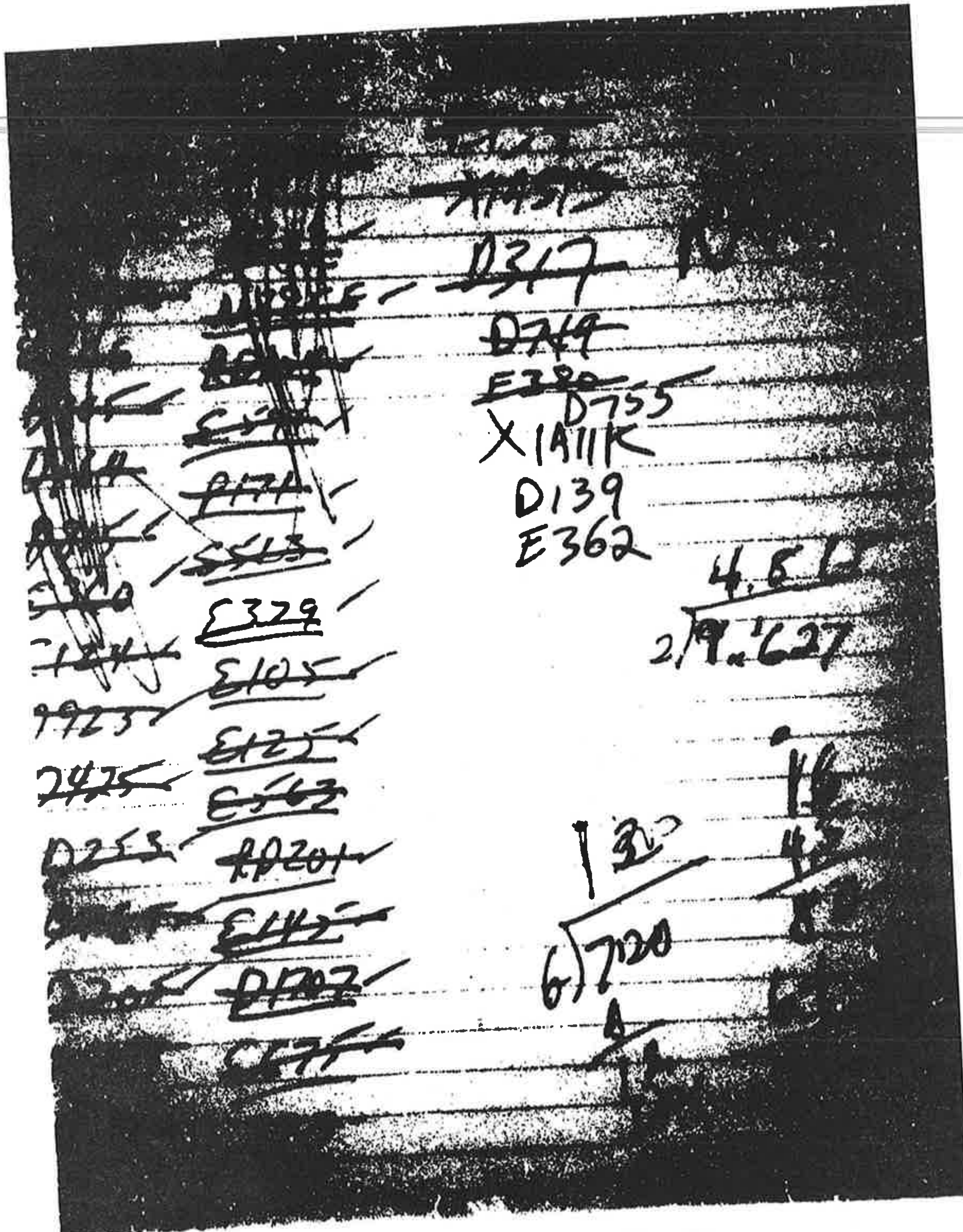


ARRIVALS ON SOUTH RUNWAY
(9R/27L OR 9L/27R)

NUMBER OF ACTIVE ENTRIES-2
(5 IS TYPICAL DAILY MAXIMUM)

MON-1 SCRATCHPAD

FIGURE 4-26. EXAMPLE MON 1/2 FLIGHT DATA LAYOUT (CONT'D)



ARRIVALS ON NORTH RUNWAY
(8/26)

NUMBER OF ACTIVE ENTRIES-4
(5 IS TYPICAL DAILY MAXIMUM)

MON-2 SCRATCHPAD

FIGURE 4-26. EXAMPLE MON 1/2 FLIGHT DATA LAYOUT (CONT'D)

- To service arrivals at 6000 ft. approaching Hartsfield-Atlanta from the downwind side (hands off to the AR positions).
- To service IFR filed overflights within the Terminal Area whenever they transition airspace allocated to the TAR, AR, or DR positions

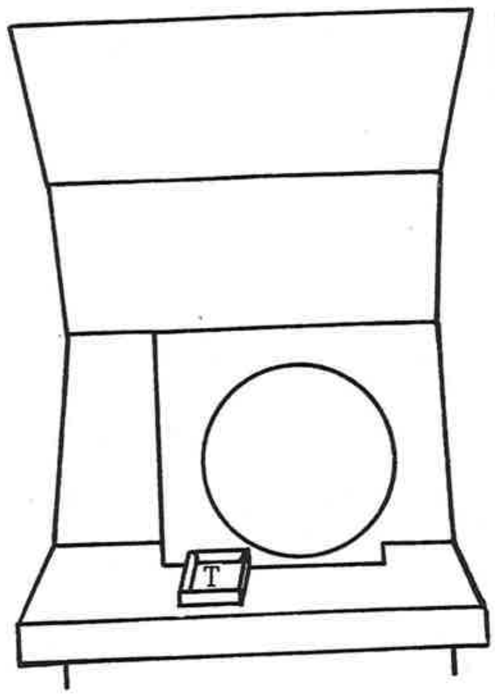
There are two DR positions currently staffed at Atlanta, DR-1 and DR-3. Typically, DR-1 will handle the departures using the eastern and southern departure gates, Figure 2-1; and DR-3 handles the departures through the western and northern gates.

The flight data layouts for DR-1 and DR-3 are shown in Figures 4-27 and 4-28 respectively. The trays in these figures only show departures from Hartsfield-Atlanta. The other three types of operations handled by DR occur relatively infrequently. Of the 812 operations handled by DR on the sample weekday, Table 4-3:

- 725 were Hartsfield-Atlanta departures
- 61 were satellite airport departures
- 25 were Hartsfield-Atlanta arrivals
- 1 was an overflight

The four types of strips are kept separate in the trays.

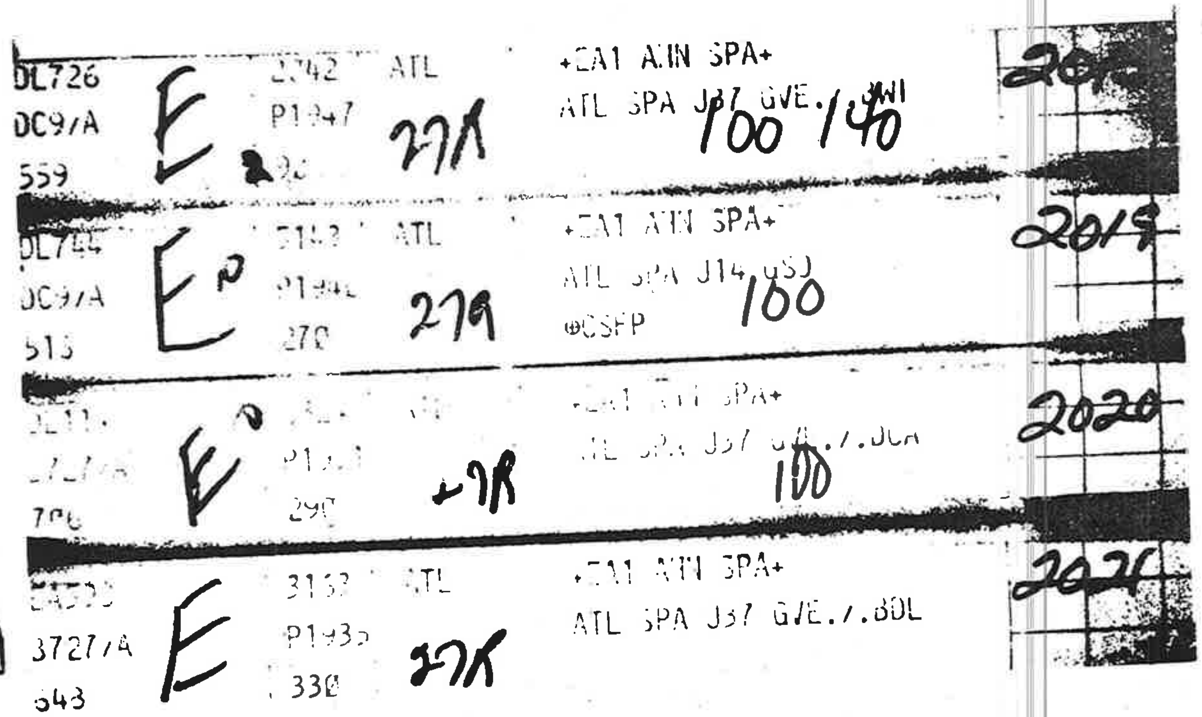
For Hartsfield departures, the flight strips arrive at the DR positions via the drop tube from the Local Control positions in the Tower Cab. The strips arrive about the time the departures lift off. DR-3 collects the strips from drop tube exit and places the strips for the flights he is to handle in his tray and passes the remaining strips to DR-1 for his use. The departure flight strips are placed in the trays in the order received from Local Control. This can be seen in Figures 4-27 and 4-28 by the fact that the lift off times marked on the flight strips increase as the eye proceeds down the tray. The DR positions routinely mark the altitude instructions issued to the departures on their flight strips. Heading instructions are also noted on the strips by some controllers, particularly if the instruction is one that is not commonly issued.



KEY FLIGHT DATA LOCATIONS
T PORTABLE FLIGHT-STIP TRAY

PHOTOGRAPH TAKEN 2022 Z-TIME
(3:22 PM LOCAL TIME)

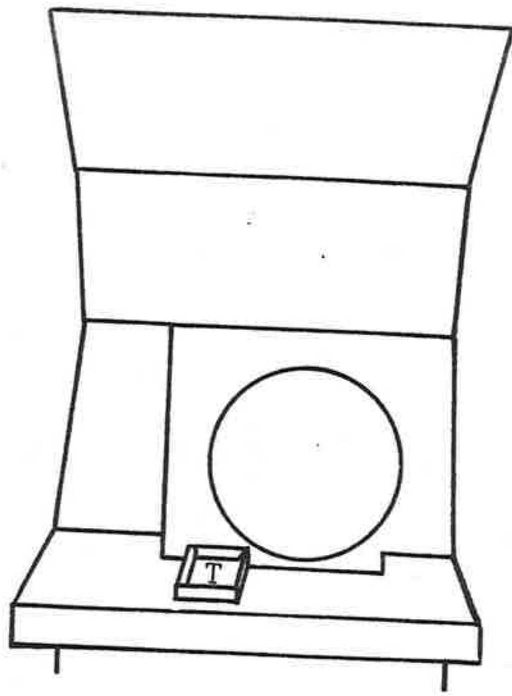
FLIGHT DATA LAYOUT AT POSITION

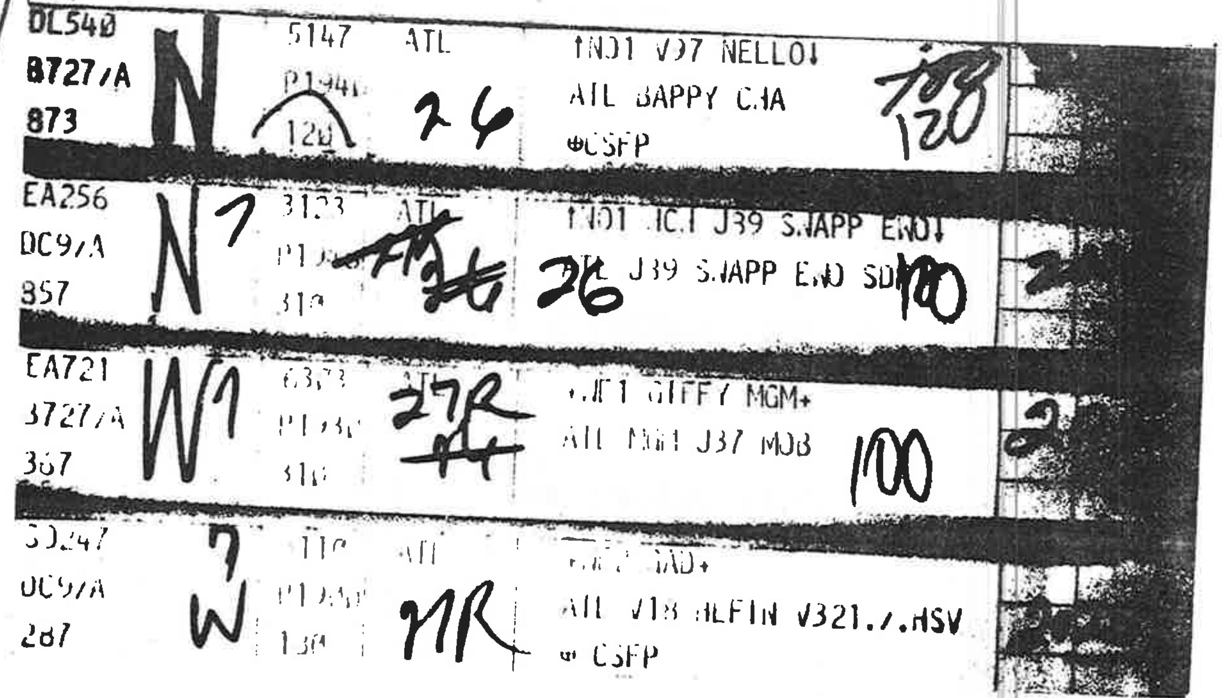


NUMBER OF FLIGHT STRIPS-4
(8 IS THE TYPICAL DAILY
MAXIMUM)

PORTABLE 10 FLIGHT-STRIP TRAY

FIGURE 4-27. EXAMPLE DR-1 FLIGHT DATA LAYOUT





KEY FLIGHT DATA LOCATIONS
T PORTABLE FLIGHT-STRIP TRAY

PHOTOGRAPH TAKEN 2025 Z-TIME
(3:25 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT POSITION

NUMBER OF FLIGHT STRIPS-4
(8 IS TYPICAL DAILY
MAXIMUM)

PORTABLE 10 FLIGHT-STRIP TRAY

FIGURE 4-28. EXAMPLE DR-3 FLIGHT DATA LAYOUT

Flight strips for departures from satellite airports are typed out on the FDEP unit at the SATH-1 position, Figure 4-2. The departures are all controlled by the satellite controllers at the lower altitudes. If the departures want to climb into Departure Radar airspace, ARTS handoffs of the flights are made from Satellite to Departure Radar, and the flight strips are delivered by a satellite handoff controller to the appropriate DR position. DR will routinely note the altitude instructions issued to the pilots on their flight strips. Later, these strips are returned to the satellite controllers for traffic counting purposes.

All flight strips for arrivals to Hartsfield-Atlanta are typed out on the two FDEP units on the Arrival Wall in the TRACON, Figure 4-2. AH will make his usual markings on the strips and will then deliver those flights approaching Atlanta downwind at 6000 ft to DR. These strips are kept separate from the others and are ordered by the sequence in which they will be handed-off to Final Control. DR will note on the flight strip when the ARTS handoff from the En Route Center is received and the altitudes issued.

4.4.2.5 Satellite Radar (SAT) and Handoff (SATH) Positions - The primary duties of the Satellite Radar positions are:

- To service IFR filed arrivals and departures to and from the satellite airports.
- To service IFR filed arrivals and departures to and from Hartsfield-Atlanta that are within Satellite Radar airspace (i.e., the airspace below the Terminal Control Area, Figure 2-6).
- To service IFR filed overflights within Satellite Radar airspace.

During the sample weekday presented in Table 4-3, SAT traffic primarily consisted of departures from Hartsfield-Atlanta and satellite airports and arrivals to the satellite airports:

o	Satellite Airport Arrivals	171 operations
o	Satellite Airport Departures	130
o	Hartsfield-Atlanta Departures	126
o	Hartsfield-Atlanta Arrivals	6
o	Overflights	9

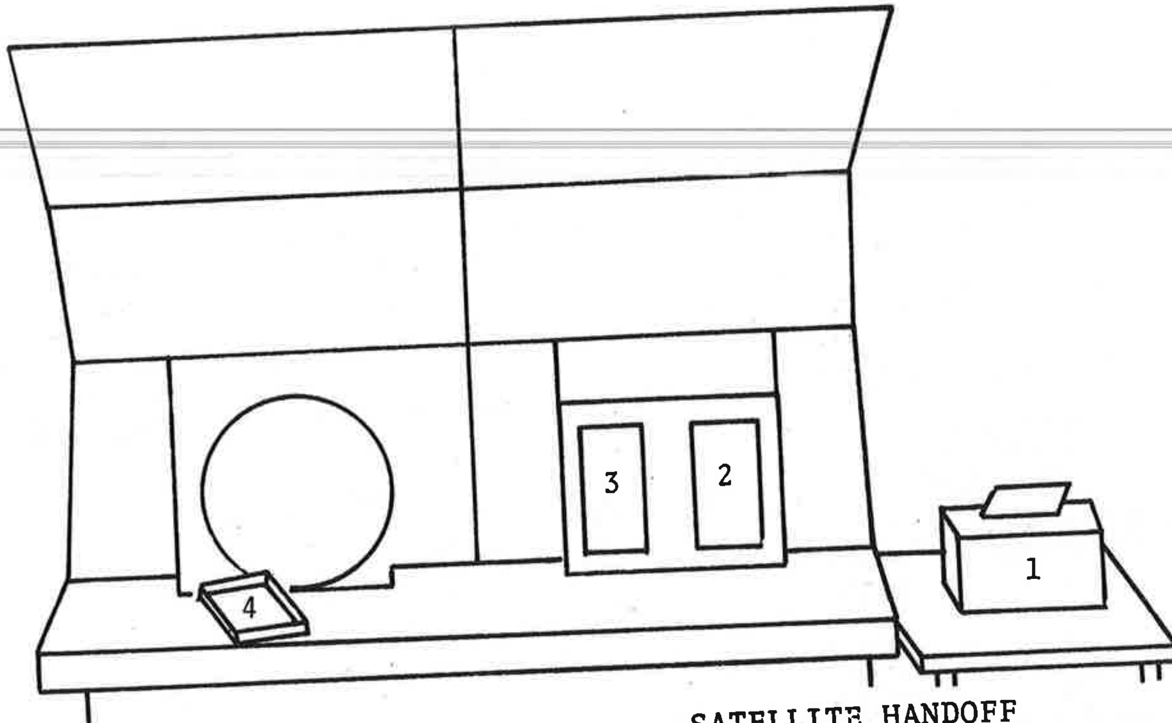
The primary duty of the Satellite Handoff positions is to keep current on the satellite operations so as to be able to assist their associated SAT positions. This assistance is typically in terms of taking TELCO calls (the intercontroller phone circuit), of performing ARTS keyboard functions, and of posting the incoming flight strips.

There are three SAT/SATH paired positions currently staffed at Atlanta. Their division of responsibility is based on a division of airspace:

- o SAT-1/SATH-1 controls the airspace to the northeast of Hartsfield-Atlanta and includes Dekalb-Peachtree (PDK) airport.
- o SAT-2/SATH-2 controls the airspace to the northwest of Hartsfield-Atlanta and includes Charlie Brown County (FTY) airport and Dobbins Air Force Base (MGE).
- o SAT-3/SATH-3 controls the airspace to the south of Hartsfield-Atlanta and includes no large satellite airports.

The flight data layouts are presented in Figure 4-29 for SAT-1/SATH-1, in Figure 4-30 for SAT-2/SATH-2, and in Figure 4-31 for SAT-3/SATH-3. Flight strips are arranged in the trays in the following manner:

- o SATH Trays - these strips are not arranged numerically by flight number due to the four and five digit general aviation flight numbers, but tend to be sorted by type of flight (i.e., arrivals, departures, and overflights) and then usually by airport.



SATELLITE RADAR
(SAT-1) POSITION

SATELLITE HANDOFF
(SATH-1) POSITION

KEY FLIGHT DATA LOCATIONS

1 FDEP PRINTER FOR SATELLITE AIRPORT ARRIVALS/DEPARTURES

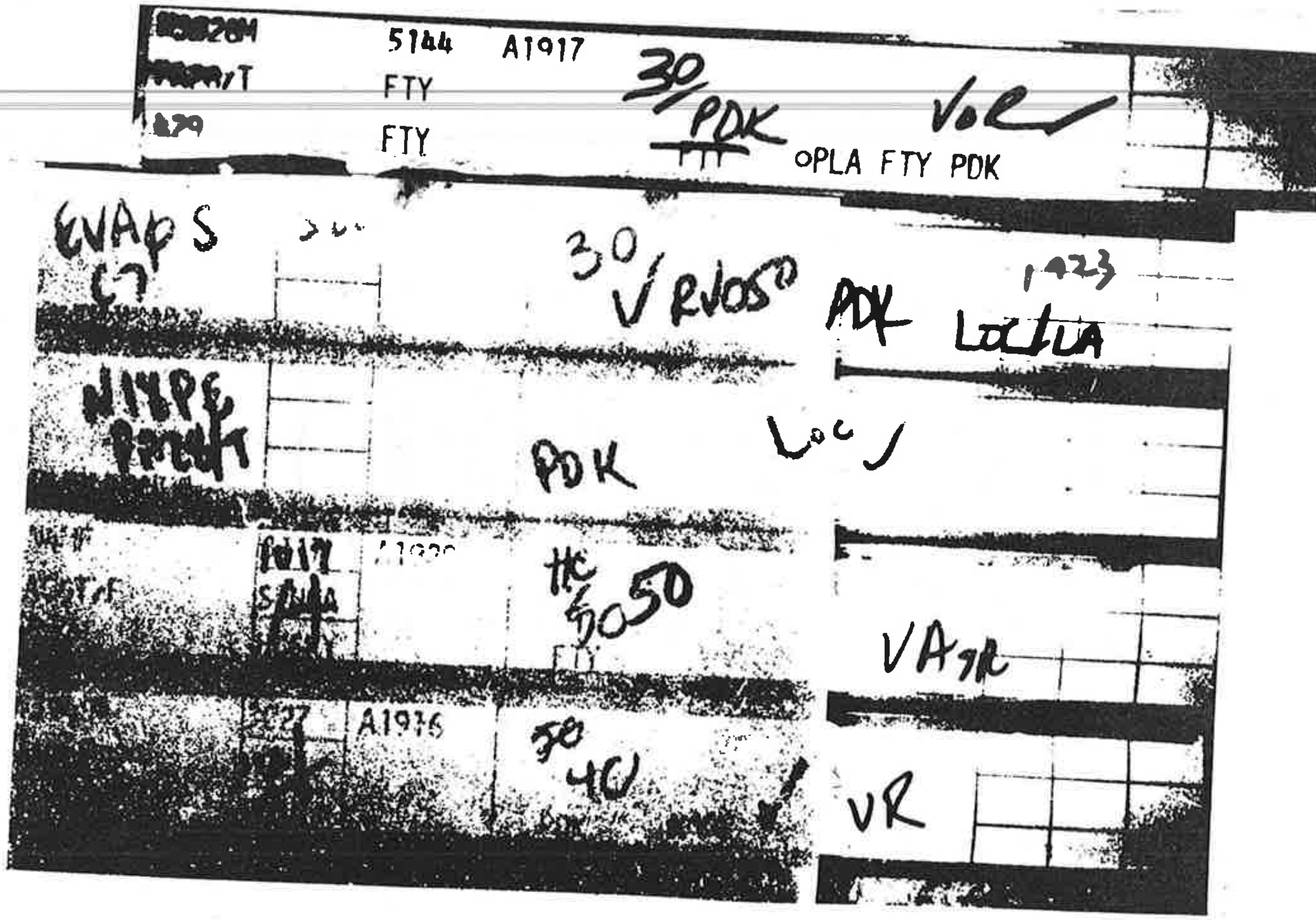
2 3 TWO CONSOLE MOUNTED 15 FLIGHT STRIP TRAYS USED BY SATH-1

4 PORTABLE 10 FLIGHT-STRIP TRAY USED BY SAT-1

PHOTOGRAPHS TAKEN 1939 Z-TIME
(2:39 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT THE SAT-1/SATH-1 POSITIONS

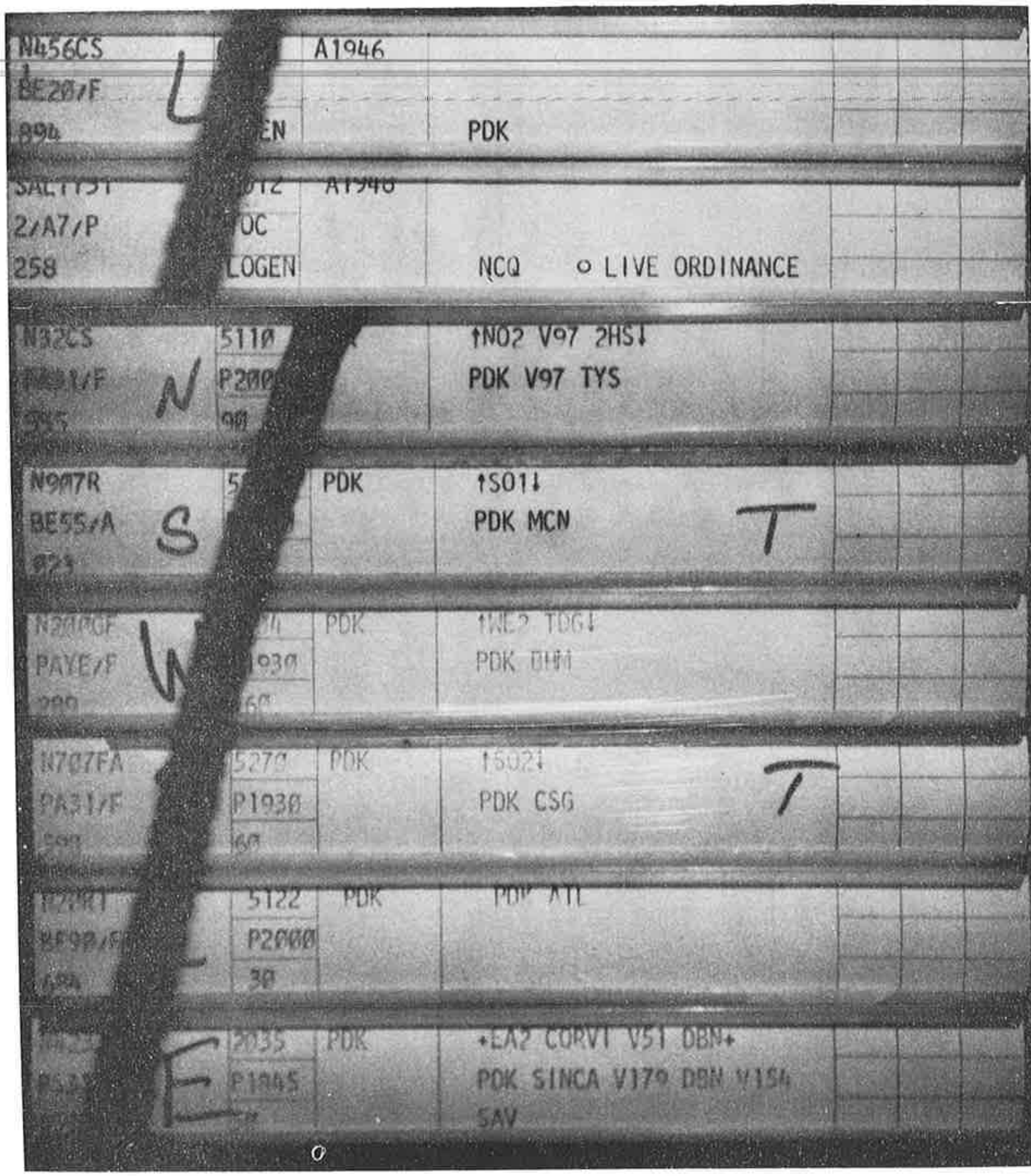
FIGURE 4-29. EXAMPLE SAT-1/SATH-1 FLIGHT DATA LAYOUT



NUMBER OF FLIGHT STRIPS-5
(10 IS TYPICAL DAILY MAX.)

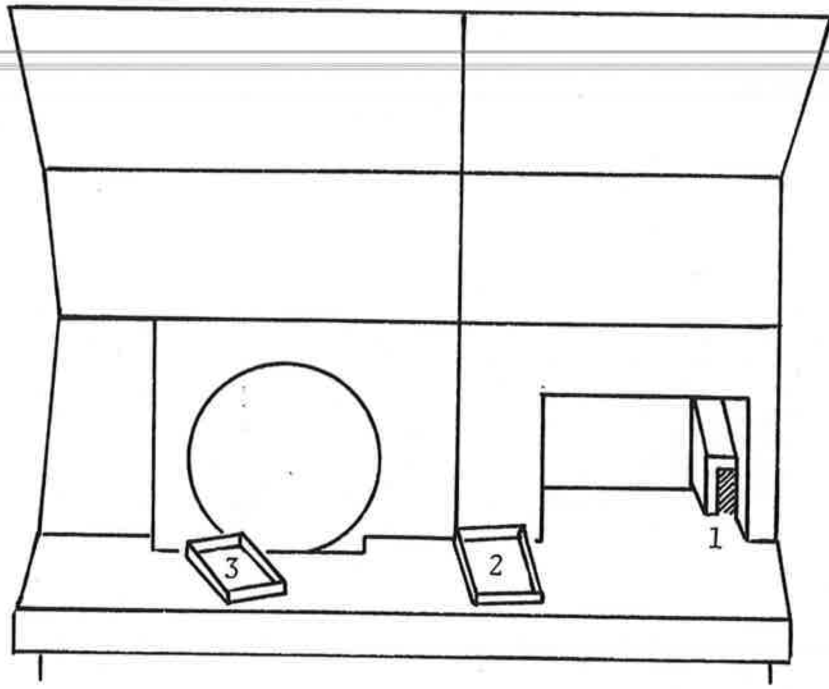
SAT-1 TRAY

FIGURE 4-29. EXAMPLE SAT-1/SATH-1 FLIGHT DATA LAYOUT (CONT'D)



NUMBER OF FLIGHT STRIPS-8
(24 IS TYPICAL DAILY MAX.)

FIGURE 4-29. EXAMPLE SAT-1/SATH-1 FLIGHT DATA LAYOUT (CONT'D)



SATELLITE RADAR (SAT-2) POSITION

SATELLITE HANDOFF (SATH-2) POSITION

KEY FLIGHT DATA LOCATIONS

1 FLIGHT STRIP DROP TUBE EXIT FROM TOWER CAB

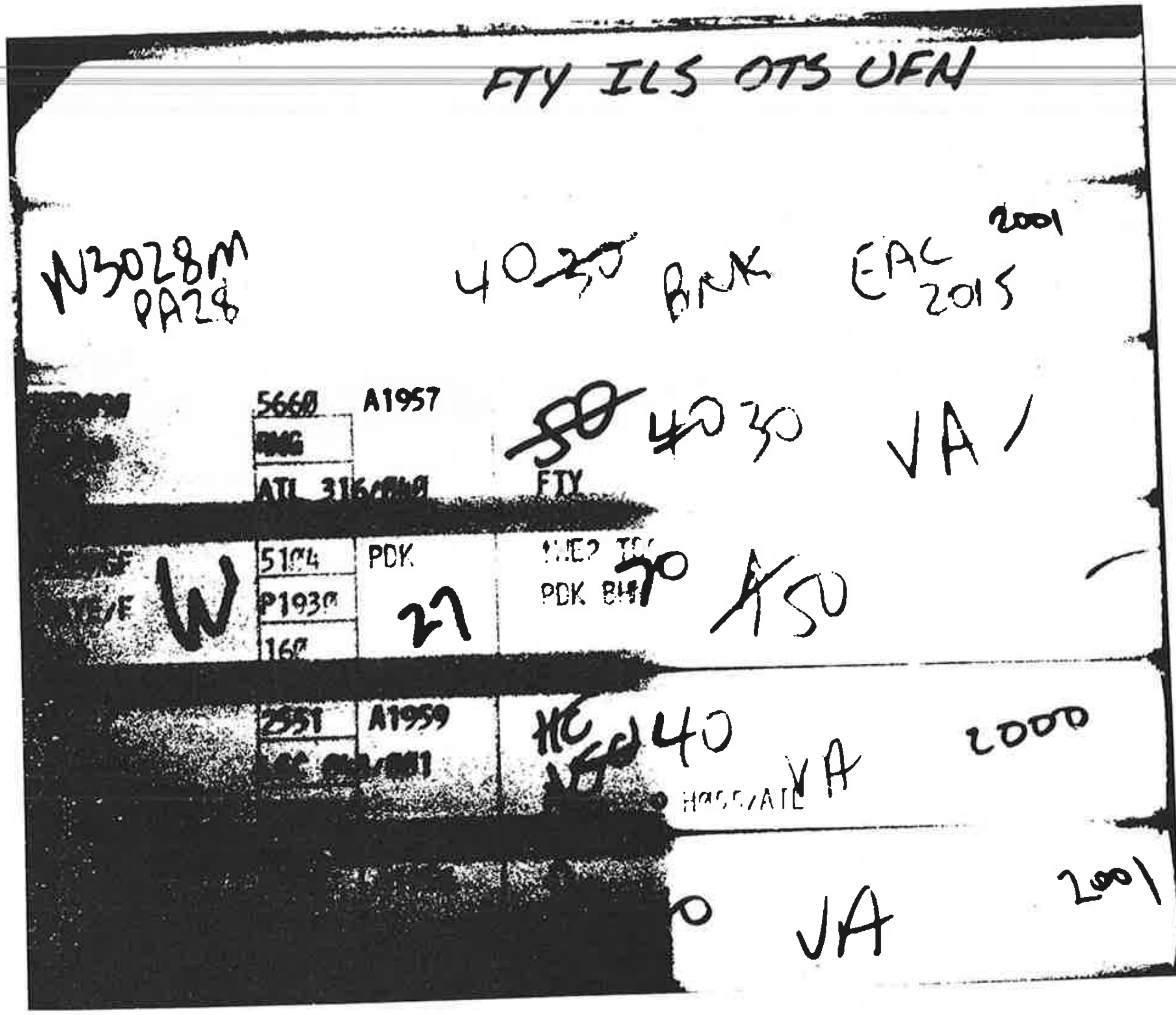
2 PORTABLE 15 FLIGHT-STRIP TRAY USED BY SATH-2

3 PORTABLE 10 FLIGHT-STRIP TRAY USED BY SAT-2

PHOTOGRAPHS TAKEN 2006 Z-TIME (3:06 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT THE SAT-2/SATH-2 POSITIONS

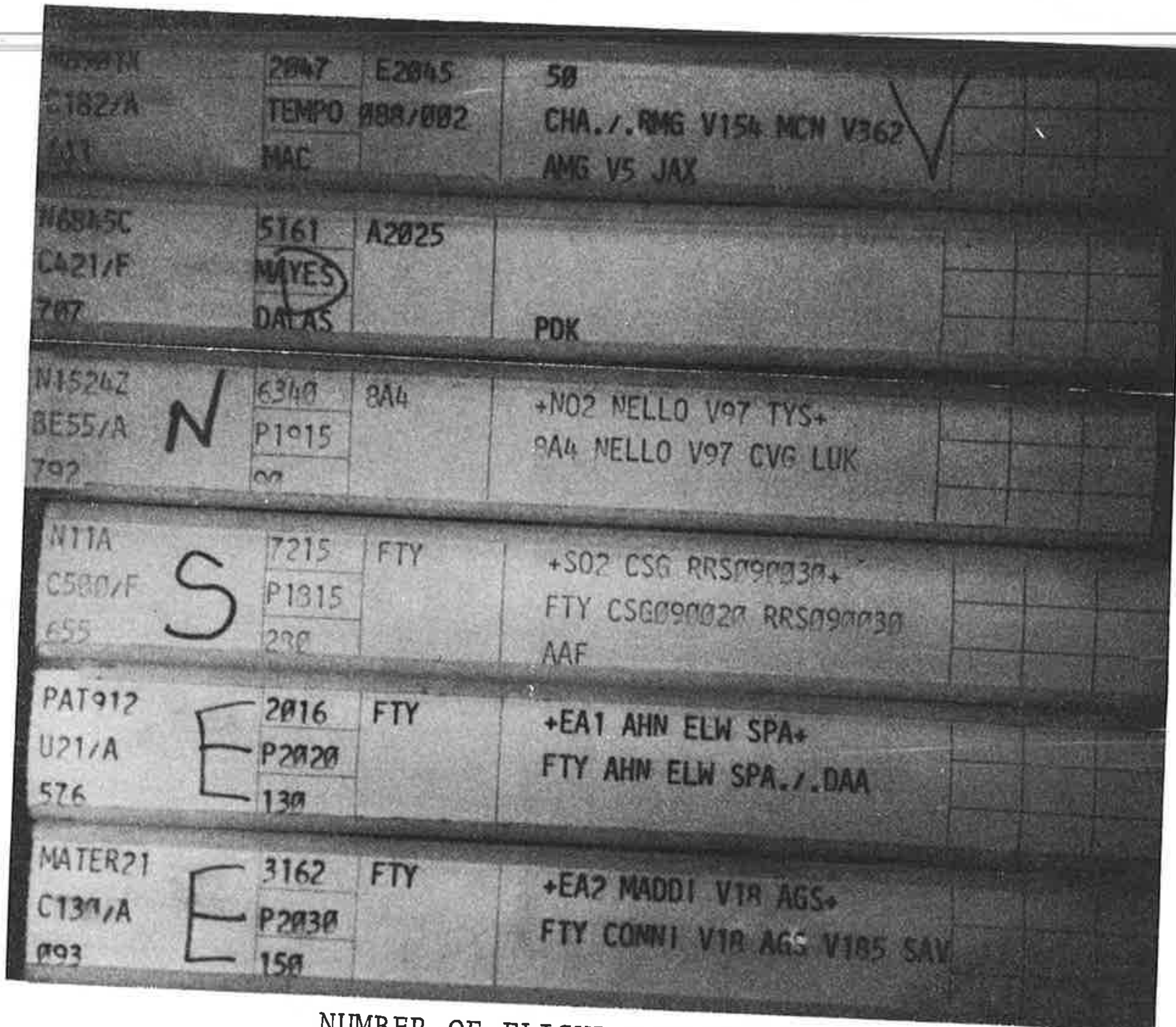
FIGURE 4-30. EXAMPLE SAT-2/SATH-2 FLIGHT DATA LAYOUT



NUMBER OF FLIGHT STRIPS-5
(10 IS TYPICAL DAILY MAXIMUM)

SAT-2 TRAY

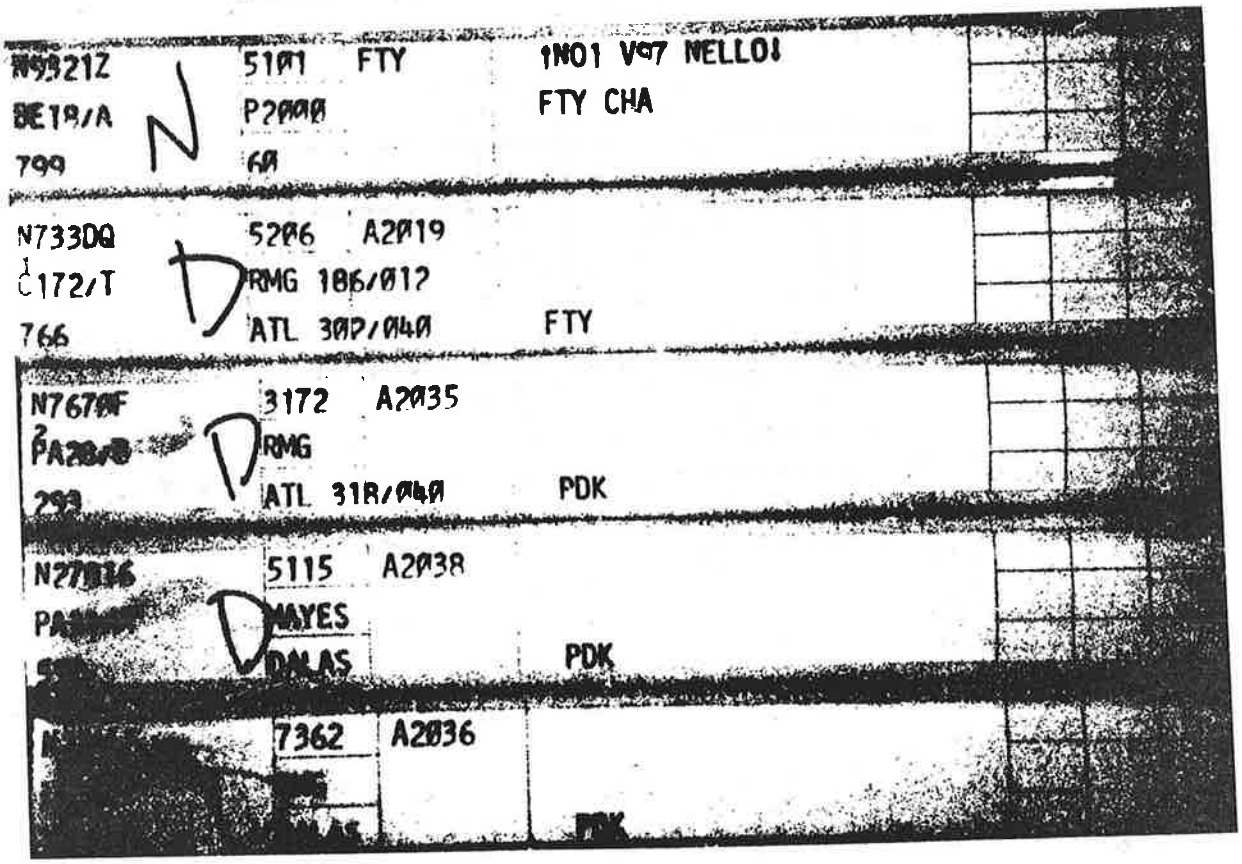
FIGURE 4-30. EXAMPLE SAT-2/SATH-2 FLIGHT DATA LAYOUT (CONT'D)



NUMBER OF FLIGHT STRIPS IN TRAY 2-11
(15 IS TYPICAL DAILY MAXIMUM)

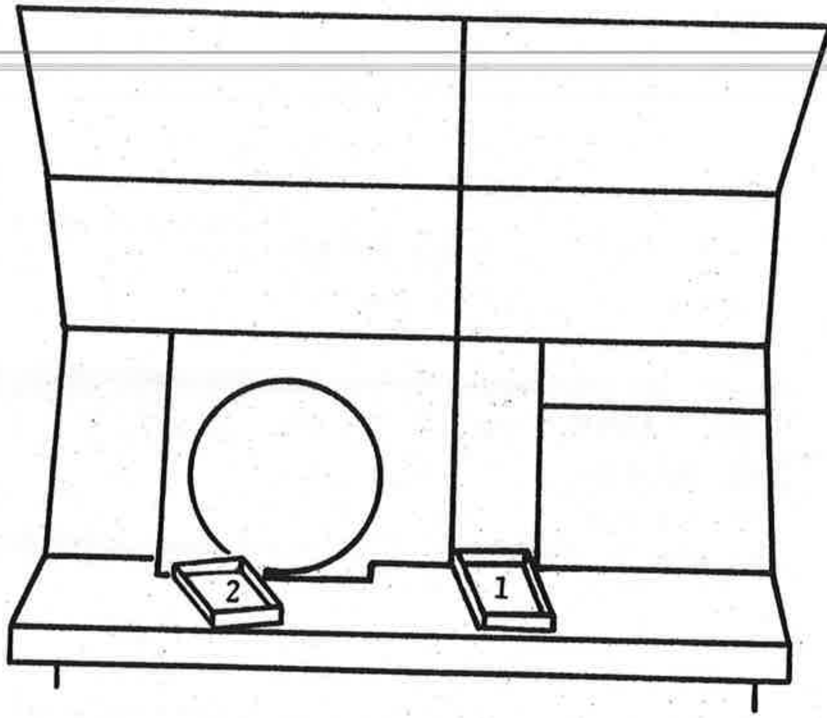
SATH-2 TRAY (TOP)

FIGURE 4-30. EXAMPLE SAT-2/SATH-2 FLIGHT DATA LAYOUT (CONT'D)



SATH-2 TRAY (BOTTOM)

FIGURE 4-30. EXAMPLE SAT-2/SATH-2 FLIGHT DATA LAYOUT (CONT'D)



SATELLITE RADAR
(SAT-3) POSITION

SATELLITE HANDOFF
(SATH-3) POSITION

KEY FLIGHT DATA LOCATIONS

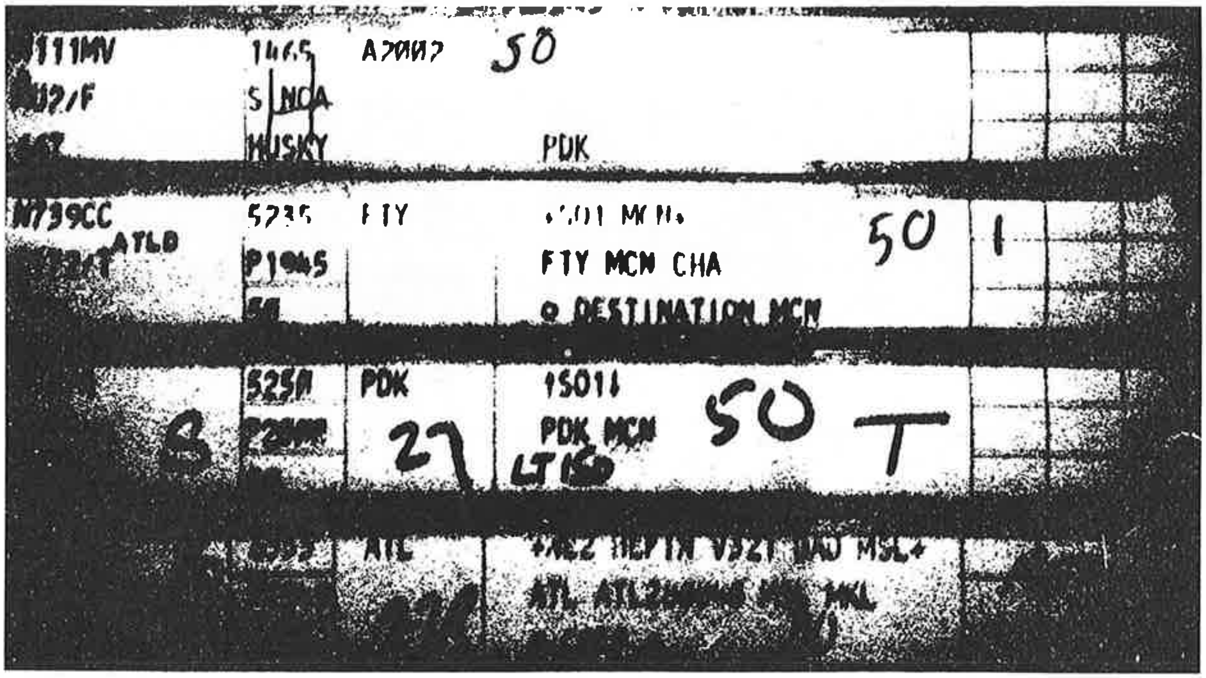
1 PORTABLE 15 FLIGHT-STRIP TRAY USED BY SATH-3

2 PORTABLE 10 FLIGHT-STRIP TRAY USED BY SAT-3

PHOTOGRAPHS TAKEN 2002 Z-TIME
(3:02 PM LOCAL TIME)

FLIGHT DATA LAYOUT AT THE
SAT-3/SATH-3 POSITIONS

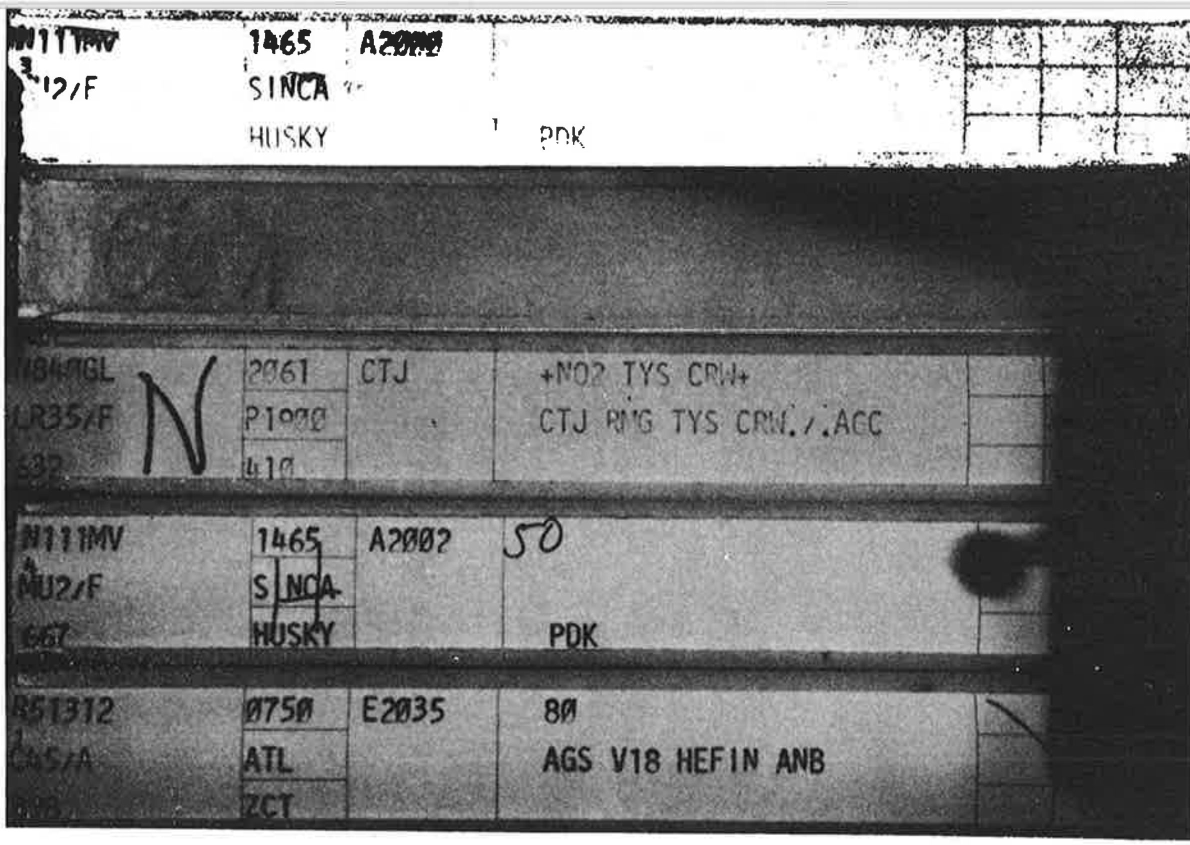
FIGURE 4-31. EXAMPLE SAT-3/SATH-3 FLIGHT DATA SETUP (CONT'D)



NUMBER OF STRIPS-4
(5 IS TYPICAL DAILY MAXIMUM)

SAT-3 TRAY

FIGURE 4-31. EXAMPLE SAT-3/SATH-3 FLIGHT DATA SETUP (CONT'D)



NUMBER OF STRIPS-4
(15 IS TYPICAL DAILY MAXIMUM)

SATH-3 TRAY

FIGURE 4-31. EXAMPLE SAT-3/SATH-3 FLIGHT DATA SETUP (CONT'D)

- SAT Trays - these strips tend to be arranged by type of flight (i.e., arrivals, departures, and over-flights) and then usually by the order in which they are received.

Flight strips are typed out on the FDEP unit at the SATH-1 position, Figure 4-2, for satellite airport arrivals,departures and overflights. SATH-1 puts the strips into holders, keeps the strips for SAT-1 at his position, and distributes the remaining strips to SATH-2 and SATH-3. These strips are usually in their trays 20 to 30 minutes before the flights are expected.

For an arrival to a satellite airport (e.g., Figure 4-13), SATH, and in the example SATH-2, will note the Coordination Fix on the flight strip shortly after receiving the strip. At ARTS hand-off of the arrival from the En Route Center, SATH-2 marks the flights altitude and time of handoff on the strip and places the strip into the SAT-2 tray. At initial call-in by the pilot of the arrival, SAT-2 will note the type of approach that is to be made and any new altitude instruction issued on the flight strip. SATH-2 than notifies the satellite airports tower cab of the arrivals:

- Flight number
- Aircraft type
- Type of approach
- ETA or distance to airport

and indicates, by means of a check mark on the flight strip, that this coordination has taken place. The flight strip is removed from the tray by SATH-2 when the tower cab calls and indicates that the arrival's landing is assured.

For a departure from a satellite airport (e.g., Figure 4-14), SATH, and in the example SATH-1, will note the Departure Vector Area on the flight strip shortly after putting the strip into his tray. When the tower cab at the satellite airport is ready to issue departure clearance to the departure, SATH-1 is contacted for permission to release the departure and is told the departure runway. SATH-1 then:

- Notes the departure runway on the flight strip
- Instructs the tower to issue a "right turn to 240°" instruction to the pilot before handoff to the TRACON, SATH-1 then marks RT240 on the flight strip
- Issues the departure release
- Puts the flight strip into the SAT-1 tray

At departure liftoff, the tower cab once again calls SATH-1 and indicates:

- The liftoff time (noted by SATH-1 on the flight strip)
- The initial altitude and heading instructions issued

SAT-1 then notes the altitude instructions on the strip as they are issued. For the strip in Figure 4-14, an ARTS handoff is made to SAT-2. The strip is placed in the SAT-2 tray and is used there until the departure is handed off to the En Route Center, when it is removed from the tray.

For an overflight through Satellite Airspace (e.g., Figure 4-15), SATH, and in the example SATH-3, marks the flight strip with the overflight symbol shortly after receiving the strip. At ARTS handoff of the overflight from the En Route Center, SATH-3 notes the time on the flight strip and places the strip into SAT-3 tray. SAT-3 then notes the altitude instructions on the flight strip as they are issued. At handoff of the overflight to the En Route Center, the flight strip is removed from the tray.

For Hartsfield-Atlanta departures that are to be handled by Satellite Control, local controllers use the drop tube to deliver the flight strips to the Satellite portion of the TRACON when take-off clearances are issued. These strips tumble out on the counter of the SATH-2 position. SATH-2 passes the strips to the appropriate SAT position. The SAT controllers will note the altitude instructions on the flight strips as they are issued. At the termination of TRACON services to the departures, their flight strips are removed from the trays.

On occasion, Satellite Control also handles an arrival to

Hartsfield-Atlanta. Typically, these arrivals approach Hartsfield-Atlanta from the upwind direction at low altitudes, and so cannot be handled by either the TAR or DR positions. The flight strips for these arrivals are handled in a manner similar to the one described for the DR case, Section 4.4.2.4, except that the role of Departure Radar is taken over by Satellite Radar.

5. STATUS INFORMATION

5.1 STATUS

This section includes a discussion of the status of equipment important for tower operations, how it is received and how it is used. This information was determined through discussions with a journeyman controller and a team supervisor from the ATL tower. To facilitate these discussions, the controller's informational requirements were divided into the following categories:

Status of equipment in the cab
Status of equipment in the TRACON
Status of Terminal Area Radio Navaids
Status of Approach Equipment
Status of Visual Aids

5.1.1 <u>Cab Status</u>

The location of weather, status, and control equipment to be considered in the designs for the Consolidated Cab Display and the controller positions where this equipment is most often used are shown for the cab in Table 5-1. Local Control -2 and 3 require status on almost all the listed equipment, while the team supervisor and Clearance Delivery need relatively little. Local Control-2 requires the most information partly because he is located physically next to the field lighting and control panels (and therefore has been given responsibility for them) and partly because he must assume responsibility for runways 9R-27L when the Local Control-1 position is not staffed. Centerfield wind is now obtained from the LLWSAS so the controllers no longer need the analog console displays. Altimeter information is shown on the BRITE display as well on the console units. Although the information on the BRITE may be more than an hour old, the controllers prefer to give that value to the arrival aircraft because it agrees with the altimeter setting on the ATIS recording. However, during periods of rapid changes in barometric pressure, they give the real-time altimeter settings shown on their console displays. The ground controllers

TABLE 5-1. CAB EQUIPMENT DISTRIBUTION AND CONTROLLER ACCESS

INTERFACE ITEMS	TS/CC	LCI	LC-2	LC-3	GC-1	GC-2	GC-3	CD/FD
	CONTROLLER POSITIONS							
CRITICAL DISPLAY DATA								
DIGITAL CLOCK	x	⊗	⊗	⊗	x	x	x	⊗
ALTIMETER SETTING		⊗	⊗	⊗	x	x	x	
CENTERFIELD WIND (ANALOG DISPLAYS)		○	○	○	x	x	x	
√ LLWSAS		⊗	x	⊗				
√ RVR		x	⊗	⊗				
ARRIVALS TO THE EAST								
9RTD, 9RM, 27LTD (9RRO)		x	⊗		x	x	x	
8TD, 26TD (8RO)				⊗	x	x	x	
ARRIVALS TO THE WEST								
27LTD, 27LM (9RM), 9RTD (27LRO)		x	⊗		x	x	x	
26TD, 8TD (26RO)				⊗	x	x	x	
ARRIVAL ATIS (FROM BRITE)	x	○	○	○		○	○	⊗
DEPARTURE ATIS (FROM WX MESSAGE)								⊗
ATL WEATHER (FROM ELECTROWRITER)	x							x
CONTROL PANELS								
√ ALS/SFL								
9R			○					
8				⊗				
MALSR								
27L		○	x					
26				⊗				
RUNWAY LIGHTS			⊗					
TAXIWAY LIGHTS			⊗					
VASI								
27R			⊗					
√ ILS MONITOR	x							

KEY ○ - LOCATION x - USER √ - AUTOMATIC MONITORING have been provided with no weather or time information from their consoles. Because departing aircraft get weather information from their companies prior to departure the ground controllers do not normally need access to weather status. However, when operating close to minimums the ground controllers must keep taxiing departures apprised of RVR values so that the pilot can estimate if his company minimums will be exceeded or not. Because GC-2 and GC-3 direct aircraft to all active runways and GC-1 (who normally handles only arrivals) needs the potential to do so, each controller must have the means of knowing the RVR at both 9-27 and 8-26 runways. Ground controllers also need altimeter and wind information for the pilot in case the ATIS goes out. Also, when barometric pressure is unstable and there are long delays between obtaining departure clearance from CD and being handed off to Local Control real time altimeter information is important. Ground controllers presently get RVR values from the local controller displays and the altimeter readings from the BRITE displays. With no console clocks, the ground controllers must also obtain the time information required to monitor traffic flow from the local controller consoles or from the BRITE displays, where it is hard to read at a distance and disappears in the event of a radar outage.

The arrival ATIS code is not required in the cab except as a reminder to the team supervisor and Clearance Delivery of the code of the last message that was recorded. However, the departure ATIS code must be known by Clearance Delivery because all departing aircraft are required to acknowledge that code to him prior to getting departure clearance. The arrival ATIS code is shown on all BRITE displays and on the CD's monitor, but the departure code is not displayed. The flight service station weather report which comes to the cab via the electrowriter is of interest to both Clearance Delivery and the team supervisor because these controllers share the responsibility of recording new ATIS messages from this information. In addition the team supervisor distributes this information to controllers whose operations could be affected by it.

The equipment listed in Table 5-1 whose status is automatically monitored is checked. Where there is no automatic monitoring, outages and malfunctions are normally detected by controllers trying to use the equipment (e.g., a radio frequency channel failure) or by a pilot who reports the outage to a controller (e.g., on a MALSR or failed light segment).

When outages in field lighting equipment or NAVIDS is detected, the controller informs the team supervisor who informs Airway Facilities (or the Department of Aviation of the City of Atlanta in case of field lighting) and controllers with an operational need to know. The supervisor calls the information down to the assistant chief who logs the outage on his Daily Record of Facility Operations (Form 7230-4) (See Figure 5-1 for an example) and the affected controllers may note the information on the back of a blank strip to be passed on to their relief. When notified AF will come out and initial the entry in the 7230-4. When the outage is corrected AF notifies the supervisor who logs the correction and informs the controllers of the change in status of the equipment. AF initials the return-to-service entry. With the possible exception of the RVR and LLWSAS, weather instrument outages are not logged.

5.1.2 TRACON Status

The location of weather, status, and control equipment to be considered in the designs for the Consolidated Cab Display and the TRACON controller positions most interested in this equipment are shown in Table 5-2. It can be seen here that almost all active arrival and departure radar positions have a complete set of information on weather status, and the satellite radar positions have console displays for altimeter and centerfield wind.

Terminal arrival, satellite, and departure radar positions need to know the arrival ATIS code because arrivals are instructed to acknowledge receipt of the code upon initial contact with the tower. Aircraft using the Standard Terminal Arrival Routes come through the TAR's airspace and acknowledge the code to him, whereas those entering the terminal area at lower altitudes (around 5,000 ft.) enter through either the satellite controller airspace or that of the departure controller and so must report the code to one of these two positions. The current code letter is shown on all the ARTS displays in the tower. The departure code is not displayed in the TRACON.

RVR information is required by TAR and AR positions because changes in runway visibility influence the spacing of the aircraft that the controllers must maintain to ensure a smooth flow of arrivals. Departure Radars - 1 and 3 must have the same information because the arrival positions are consolidated here during the mid-shift.

Time and altimeter console displays are required at most radar stations as back-up information sources in the case of an ARTS failure - TAR-3 and AR-2 do not currently have altimeter displays. The information is also required at Departure Radar Positions 1 and 3, because of their consolidation function.

Centerfield wind is required by arrival and satellite radar positions. Arrival Radar issues wind often, particularly when visual spacing of aircraft is dependent upon wake vortex dispersion. Satellite controllers give Atlanta wind and altimeter information to pilots landing at satellite airports without it, particularly at night.

Updating and distribution of ATL weather information in the TRACON is the responsibility of SATH-2 and AH-3, but they are often too busy to do it. Normally the wall supervisors get this information from the electrowriters and give it to the affected controllers.

5.1.3 Terminal Area Radio Navaids

Although not initially the case, remote maintenance monitoring may eventually extend to terminal area radio navaids. Since radio navaids serve an important guidance function for aircraft entering and leaving the Atlanta terminal area, a study was made of the desirability of presenting this information to the controllers. Radio navaids associated with arrival and departure fixes to Atlanta and its satellite airports are shown in Table 5-3 with the controllers of potential interest listed as column heads. The circles indicate the navaids used by aircraft monitored by the indicated controllers. These associations were determined through an analysis of departure flight strips SID charts, and STAR charts. The X's indicate the controllers that would find status information on the indicated equipment useful, as determined in interviews with tower controllers.

These discussions revealed that controllers working with arrivals don't need the status of VORTAC's used by these aircraft. In the case of VORTAC outages, aircraft are cleared direct to the Atlanta VOR; and the controllers do not become interested in the aircraft until they have arrived in the terminal area. TRACON controllers do not really need the status of VORTAC's used for departures either. As long as the radar is working, departure controllers can vector aircraft to departure fixes using their ARTS displays. However, these controllers like to know VOR status so that they can alert pilots to what they can expect in terms of VOR guidance. Also, satellite controllers need the information so they know how to direct aircraft to satellite airports, particularly at night when the towers at these areas may be closed.

With one exception, status on this off-site equipment is not detected and reported automatically. Status of the Atlanta VORTAC is currently being received in the tower. The Atlanta VORTAC is particularly important to operations in the terminal area because of its central location so real time status of their equipment is available to the assistant chief through a status of this equipment is located near his desk (Figure 5-2). If he sees the equipment go out, he can dial back-up equipment into action directly from the panel.

Notices of off-site equipment outages are received by pilot reports from the Atlanta Flight Service Station, and from towers at the affected satellite airports. Occasionally the first notifica-

TABLE 5-3. RADIO NAVAIDS AND CONTROLLERS OF POTENTIAL INTEREST

	CONTROLLER POSITIONS AND AREAS INTEREST									
	ARR FIXES		ATL RUNWAYS		DEP GATES		TA QUADRANTS			
	TAR-2	TAR-3	AR-1	AR-2	DR-1	DR-3	SAT-1	SAT-2	SAT-3	ASS'T. CHIEF
AREA OF RESPONSIBILITY	NE/NW	SE/SW	9R/27L 9L/27R	8-26	N_1/N_2 W_1/W_2	S_1/S_2 E_1/E_2	NE	NW	S	
RADIO NAVAIDS										
Atlanta VORTAC (ATL)	O	O	O	O	O		O	O	O	x
Athens VORTAC (AHN)	O	O				x				
Lagrange VORTAC (LGC)	O	O			x					
Columbus VORTAC (CSG)		O				x				
Rome VORTAC (RMG)	O	O								
Macon VORTAC (MCN)						x				
Augusta VORTAC (AGS)						x				
Knoxville VORTAC (TYS)					x					
Tocco VORTAC (TOC)					x					
Hinch Mtn. VORTAC(HCH)					x					
Chattanooga VORTAC (CHA)					x					
Gadsden VORTAC (GAD)					x					
Vulcan VORTAC (VUZ)					x					
Talladega VORTAC (TDG)					x					
Montgomery VORTAC (MGM)					x					
Coweta NDB (CCO)									x	
Carrollton NDB (CTY)									x	

Key O Location x-Users

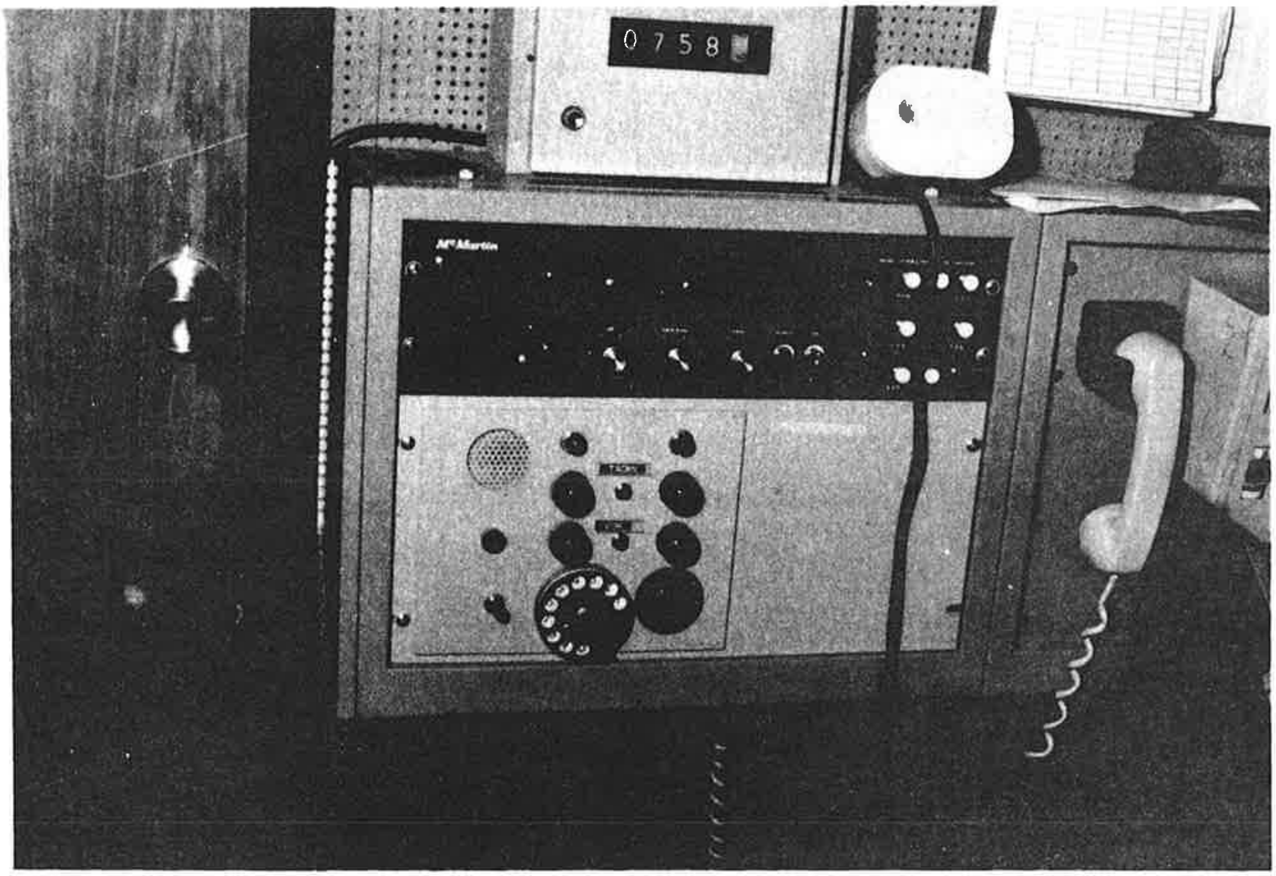


FIGURE 5-2. ATL VOR TRACON STATUS AND CONTROL PANEL

tion of equipment outages will be from a pilot, but more usually this information is telephoned directly to the assistant chief by the Flight Service Station or the tower of the affected satellite airport. When this information is received the information is distributed by the assistant chief as a NOTAM (Section 5.2).

5.1.4 Approach Equipment

Aircraft arriving at Atlanta track a descent profile described in approach plates for the different runways. Intersection points defined by the crossing of VOR directional signals and ILS signals aligned with the runway provide the pilot with reference points for altitude changes required by those profiles. For example, when on "final" to runway 8, the "CHINN" intersection at which descent is started from 5000 ft. is defined by the intersection of the Fulton County VOR at 226° and the ILS for that runway. LOM CATTA beacon indicates when the ILS glide slope should be intercepted, and the MM indicates the distance from the touchdown zone at which the aircraft should be at an altitude of approximately 200 ft.

Table 5-4 is a listing of the radio navaids used by arrivals to Atlanta and its satellites and the controller positions interested in the status of the equipment. Figure 5-3 is an illustration of the aids important to Hartsfield-Atlanta. As shown in Table 5-4, TAR, AR, and DR controllers must know the status of ILS equipment for the runways that they service. During IFR landings, the status of the ILS equipment influences landing minimums and the spacing of arrivals. And, simultaneous parallel approaches cannot be made if the localizer is out. The departure radar positions have to have status on approach equipment because they are consolidation positions.

The status of non-ILS radio aids, such as the FTY VORTAC is important only to the satellite controllers. Pilots are informed of outages of these aids by ATIS messages and apparently can compensate easily for them by using back-up equipment - such as the Bankhead VORTAC. Satellite controllers do want to know the

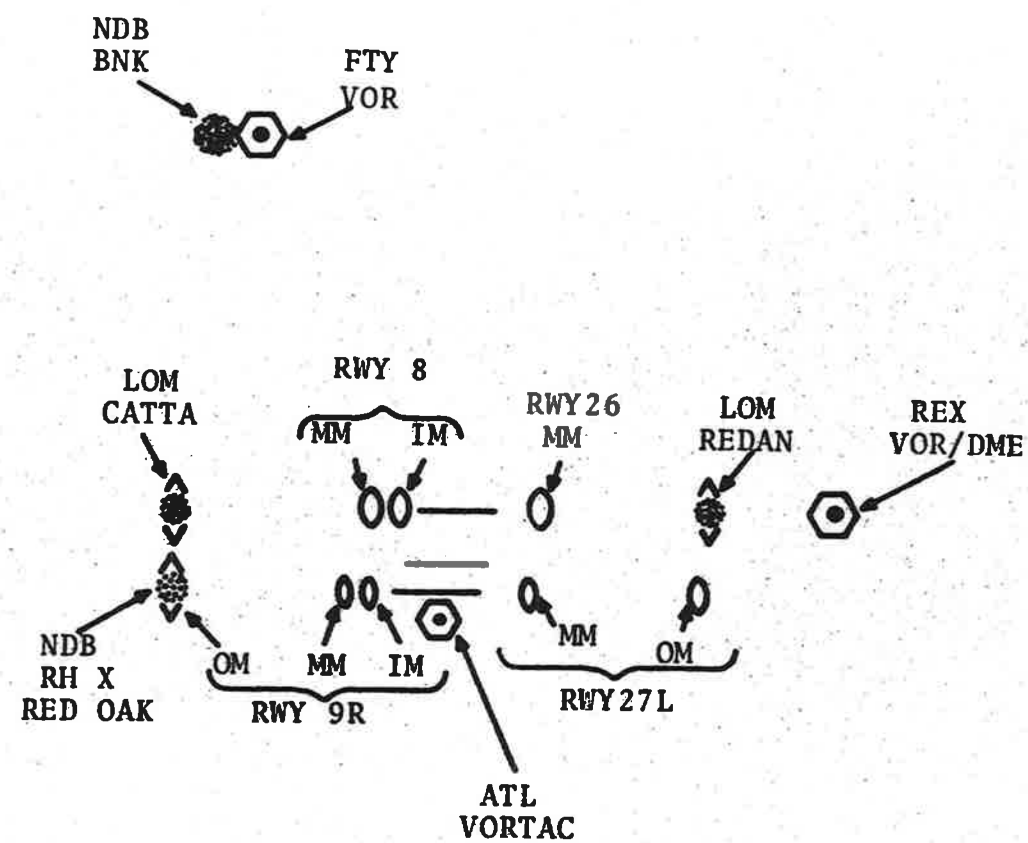


FIGURE 5-3. RADIO NAVAIDS LAYOUT NEAR HARTSFIELD-ATLANTA

TABLE 5-4. APPROACH NAVAIDS AND CONTROLLERS OF POTENTIAL INTEREST

RADIO NAVAIDS	ARR FIXES TAR-2 NE/NW	ARR FIXES TAR-3 SE/SW	ATL RUNWAYS AR-1 9R/27L 9L/27R	ATL RUNWAYS AR-2 8/26	DEP GATES DR-1 N_1/N_2 W_1/W_2	DEP GATES DR-1 S_1/S_2 E_1/E_2	TA QUADRANTS SAT-1 NE	TA QUADRANTS SAT-2 NW	TA QUADRANTS SAT-3
LOM CATTA (AT)			⊗	⊗					
RED OAK NDB (RHX)			⊗						
LOM REDAN (BR)			⊗	⊗					
MM, IM, LOC, GC (LOC, GC: I ATL) RWY 8(ATL)	⊗			⊗		⊗			
MM, IM, LOC, GC (IM, LOC: I FUN) RWY 9R(ATL)		⊗	⊗		⊗				
NORCROSS VORTAC (OCR)				○			⊗		
MM, LOC, GS (LOC, GS: I-BRU) RWY 26(ATL)	⊗			⊗		⊗			
MM, LOC, GS (LOC, GS: I FSQ) RWY 27L(ATL)		⊗	⊗		⊗				
BANKHEAD NDB (BNK)								⊗	
OM, MM, LOC, GS (LOC, GS: I FTY) RWY 8R(FTY)								⊗	
OM, MM, LOC (I PDK) RWY 20L(PDK)							⊗		
Fulton County VOR(FTY)				○					○
REX VOR/DME(REG)									

status of VORTAC's and other radio approach equipment to the satellite airports because of the high frequency of outages of the satellite equipment and the impact of some outages on landing operations. For example, at night when the towers are not operating, a middle marker outage can increase landing minimums.

TRACON controllers currently get the status of Atlanta and satellite approach equipment through NOTAMS and indirectly from the ILS and LOM panels in the cab through cab controllers.

5.1.5 Visual Aids

The visual aids at Atlanta and its satellite airports are shown in Table 5-5 and are associated with the controller and supervisor positions interested in their status. Terminal Area Radar and AR controllers need to know the status of visual aids on the runways that they serve because pilots often must be alerted to such outages, and because under IFR weather, certain conditions can reduce operating efficiency and so increase the spacing which the controller must maintain in the stream of arrivals. This same information must be presented to the DR-1 and DR-3 positions because the TAR and AR functions are consolidated here during the midshift. Satellite controllers want to know lighting status at both towered and non-towered airports; and, although less important, they would also like to know lighting status at nearby fields not officially served. They expressed no interest in having this information on such outlying airports as Macon, Augusta, and Columbus, for example.

The team supervisors determine which controllers need the status information that arrives in the TRACON; they get the information to the controller and call his attention to it. Therefore, each supervisor must have all the information that his controllers may need.

With the exception of the local airports not officially serviced by the Atlanta tower, the TRACON currently maintains status information on the airports listed in the table. Status information is reported to the assistant chief (and in some cases

TABLE 5-5. VISUAL AIDS AND CONTROLLERS OF INTEREST

AIRPORTS	VISUAL AIDS	TAR-2 8/26	TAR-3 9R/27L 9L/27R	AR-1 9R/27L 9L/27R	AR-2 8/26	DR-1	DR-3	SAT-1 NE	SAT-2 NW	SAT-3 SE-SW	TS/CC ARRIVALS	TS/CC DEPARTURES	ASST. CHIEF
Hartsfield (ATL)	8-26 HIRL, CL	x			x		x				x		x
	8 ALSFI, TDZ	x			x		x				x		x
	26 MALSR	x			x		x				x		x
	9R-27L HIRL, CL		x	x		x					x		x
	9R ALSF2, TDZ		x	x		x					x		x
	27L MALSR		x	x		x					x		x
	9L-27R HIRL, CL		x	x		x					x		x
	27R VASI		x	x		x					x		x
TOWERS													
Charlie Brown(FTY)(NW)	8R-26L HIRL								x			x	x
	8R MALSR								x			x	x
	26L REIL, VASI								x			x	x
	14-32 MIRL								x			x	x
	14 REIL, VASI								x			x	x
Dekalb Peachtree (PDK)(NE)	2R-20L HIRL							x				x	x
	2R MALSF							x				x	x
	16-34 MIRL							x				x	x
	16 MALSR, REIL							x				x	x
	9-27 HIRL							x				x	x
NO TOWERS													
Cartersville (BAO)(NW)	18-36 MIRL								x			x	x
Covington (9A1)(SO)	9-27 MIRL									x		x	x
Falcon Field (2A9)(SO)	13-31 LITL									x		x	x
	13 REIL									x		x	x
	31 REIL									x		x	x
Griffen-Spaulding(6A2)(SO)	13-31 MIRL									x		x	x
Swinnett Co. (17A)(SO)	7-25 MIRL									x		x	x
Newnan Coweta(CCO)(SO)	14-32 LIRL									x		x	x
West Georgia Reg.(CTJ)(SO)	16-34 MIRL									x		x	x
	34 REIL									x		x	x
NOT SERVICED													
Bear Creek(4A7)(SO)	6-24 LIRL									x		x	x
Berry Hill (4A0)(SO)	11-29 LIRL									x		x	x
McCollum(8A4)(NW)	9-27 MIRL								x			x	x
South Expy(9A7)(SO)	6-24 LIRL									x		x	x
Stone Mtn.(00A)(NE)								x				x	x

to the satellite controllers) by the towers (where present) of the affected airports through pilot reports and by responsible local officials (e.g., the chief of police) at the smaller airports. The controller also calls the Flight Service Station for status at airports of particular interest. Reports of outages at satellite airports are screened by the assistant chief and distributed to the team supervisors as NOTAMs. These NOTAMs are not logged.

5.2 NOTAMS

The NOTAMs arriving at Atlanta tower are usually concerned with outages of equipment or facilities of interest to pilots landing at Hartsfield-Atlanta or the satellite airports. These notices come to the assistant chief in the TRACON by telephone and by mail, and they are usually from the City of Atlanta or from the flight service station (FSS). NOTAMs telephoned by the flight service station are usually followed by a teletyped message.

The assistant chief is responsible for distributing the NOTAMs to the controllers. NOTAMs of concern to the cab are delivered to the cab coordinator by telephone and then, if particularly important, followed by a descriptive note or actual copy of the NOTAM. When the notice arrives in the cab the coordinator will alert the relevant controllers and leave a copy of the NOTAM on one of the consoles where it is out of the way, but can be seen by controllers coming on duty (Figures 5-4 and 5-5). At the end of the watch, the coordinator will alert his replacement to the NOTAMs which will be in effect during the next eight hours.

If the NOTAM is of general interest to the pilots and to stay in effect for a long time it may be included in the ATIS message. When appropriate, the controllers also pass the NOTAMs on to the pilots who may be affected. NOTAMs are discontinued by direction of the assistant chief or when the time frame indicated in the notice has passed. When deleted, NOTAM messages are thrown away at the convenience of the cab controllers. Rarely is more than one NOTAM in effect at one time in the cab. And, since all NOTAMs are screened by the assistant chief, duplicate and irrelevant

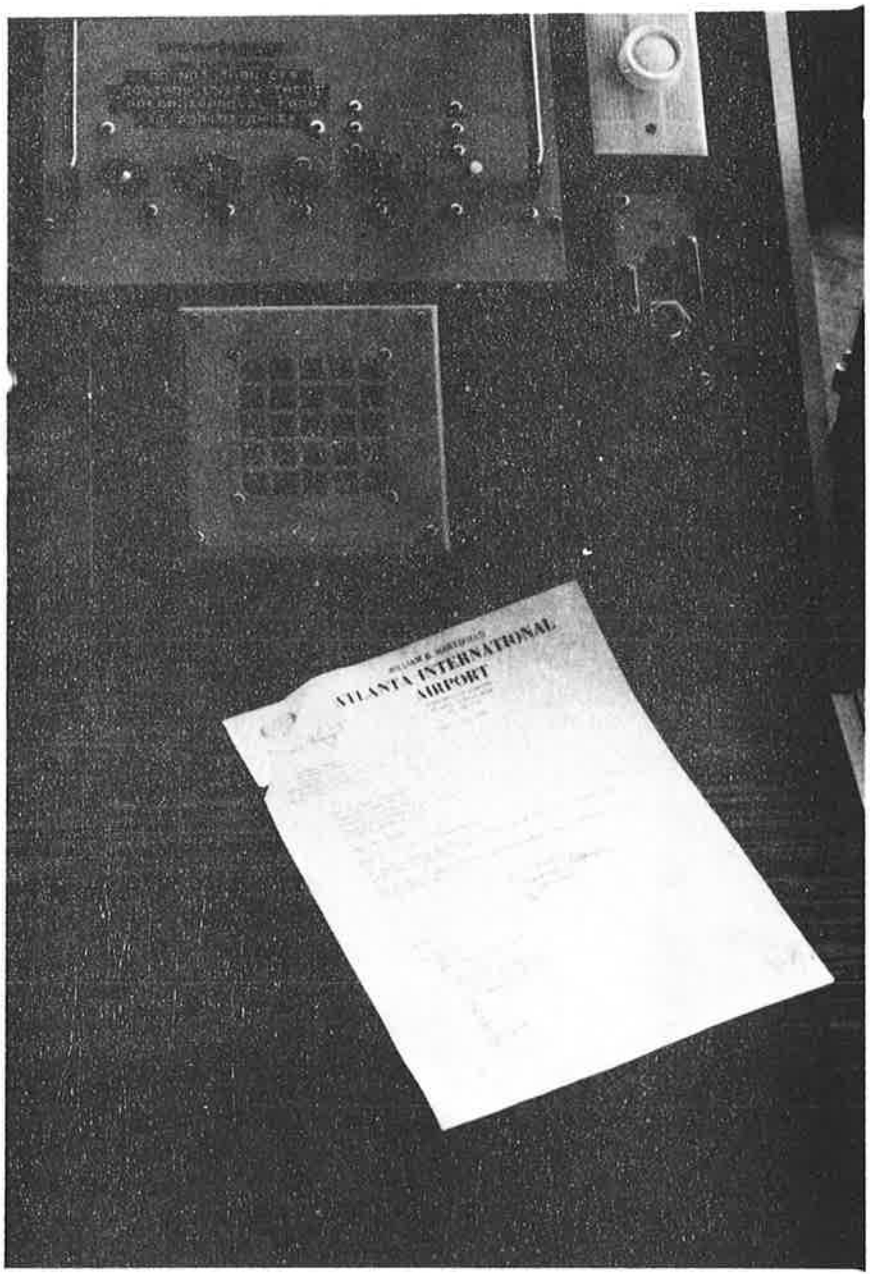


FIGURE 5-4. NOTAM IN CAB

NOTAM's are not distributed within the cab.

The procedure used in the cab for handling NOTAM's is not formal or standardized. Controllers appear to respond to each notice as the needs of the situations indicate, and this approach appears to work very well. NOTAMS are distributed in the TRACON in several different ways. The assistant chief gives notices arriving during the shift to the appropriate team supervisor who passes them on to the affected controller. Depending upon its duration and importance, the affected controller may be simply told about it, or he may be told and given a written note as a reminder to alert relieving controllers arriving for subsequent watches. These notes are written on anything available such as the back of a flight strip or on paper from an electrowriter. The message is then posted near the controller wherever there is a means to do so. There is no standardized procedure for handling these announcements.

There is rarely more than one notice posted at one time, but as many as three at a time do occur. Satellite NOTAMs tend to stay up longer than others because they are often concerned with equipment outages that depend upon the condition of the budgets of small cities for the equipment to be repaired. NOTAMs on the construction at Atlanta may also stay a while and, during the present period of airport expansion, tend to be the most frequent. When NOTAMs are cancelled the assistant chief walks through the TRACON, takes the notes down and informs the controllers of the cancellations through their team supervisors.

A new system for transmitting NOTAM information to the controllers which reduces the number of posted NOTAM messages and may increase the controllers awareness of these notices has been started in the TRACON. Each morning the assistant chief makes a tape recording of the notices affecting satellite operations during that day. Any controller may hear this recording over headsets by pushing the TELCO key pack button labeled "FBL". The TRACON radar controllers are instructed to listen to the recording each day before they start their watch. The following information was on the recording on the morning of April 26:

"April 26

Gwinnett County closed at night;

Norcross VOR 1403155 not useable

below 5000 feet beyond 17 nautical miles;

Griffon Airport runway lights out of service;

Fulton County ILS out of service;

West Georgia NDB out of service."

This message is updated each morning, if only by changing the date.

Long term NOTAMs of general interest are written in grease pencil on the bottom of the traffic count bulletin board (Figure 5-6) located to the left of the door to the TRACON (Figure 3-2) where it can be seen by controllers entering that room. The following notice was observed there on April 26:

"231400 Z FTY ILS OTS FOR 2 WEEKS
GS RWY 26 NORTH SIDE"

NOTAM's generated by the city are mounted on a clipboard (Figure 5-7) hung to the right of the assistant chief's desk (Figure 5-8). Team Supervisors are instructed to review these notices each time that they come to work so that they can inform their controllers of important changes. Notice with regard to Figures 5-4 and 5-7 that the same notices are shown as being relevant for both cab and TRACON operations.

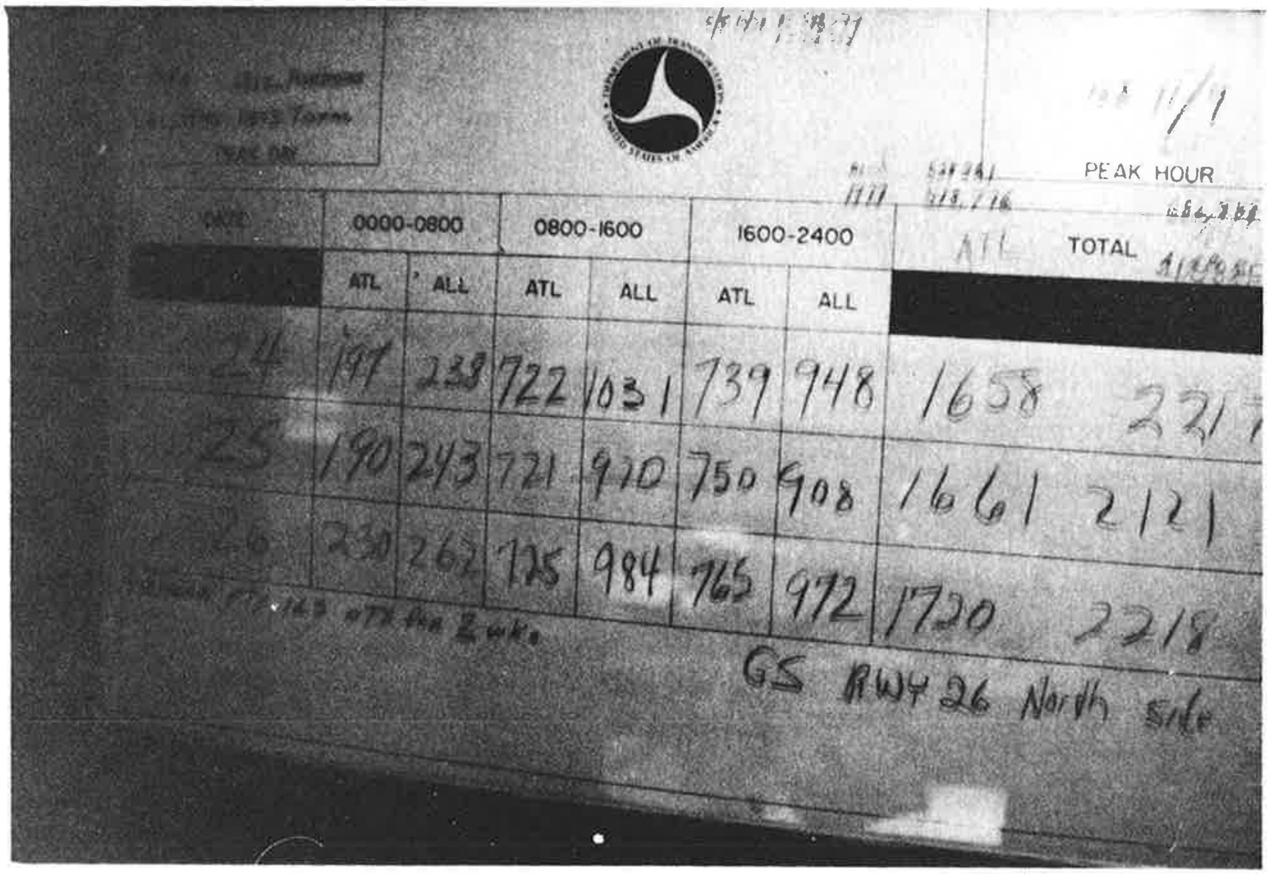


FIGURE 5-6. TRAFFIC COUNT BULLETIN BOARD IN TRACON

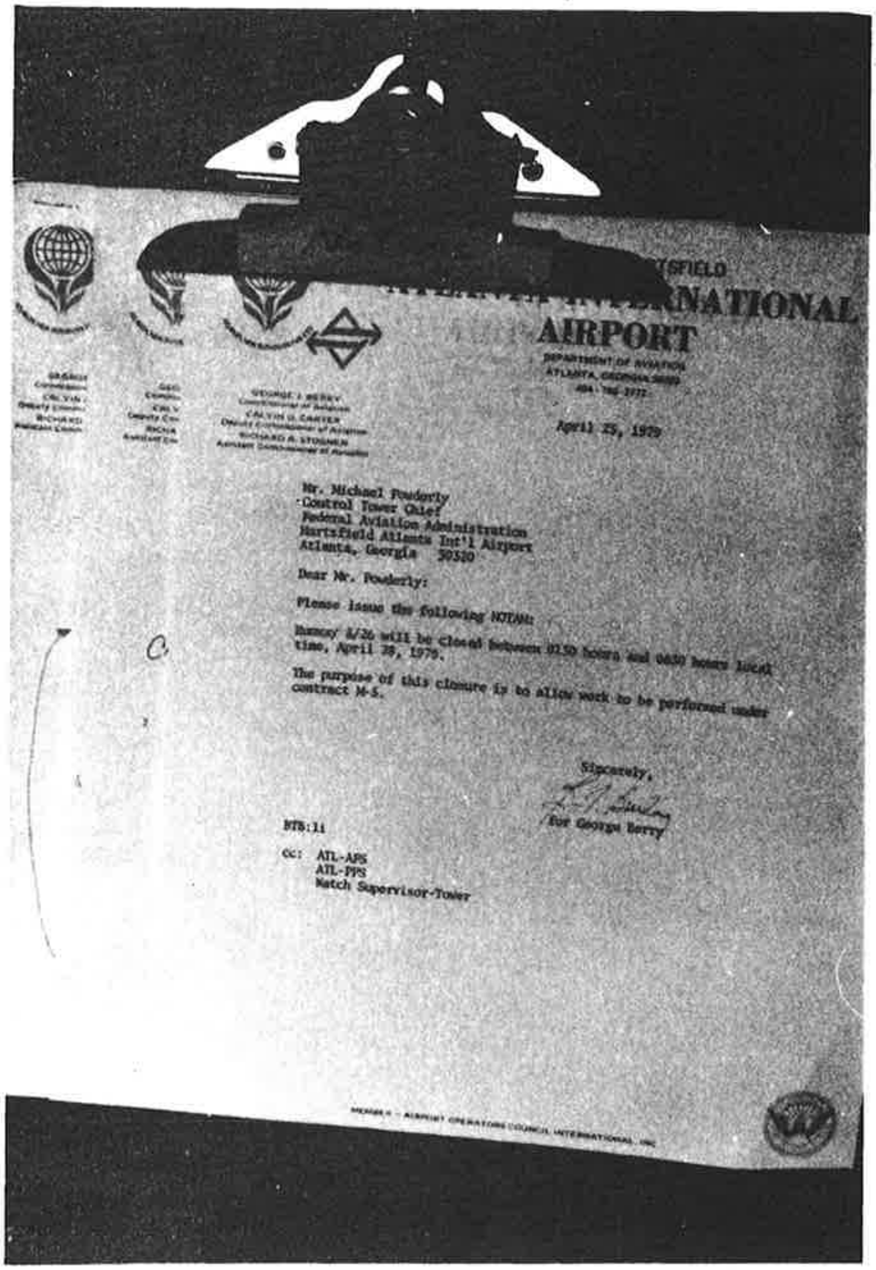


FIGURE 5-7. CLIPBOARDS FOR NOTAMS IN TRACON

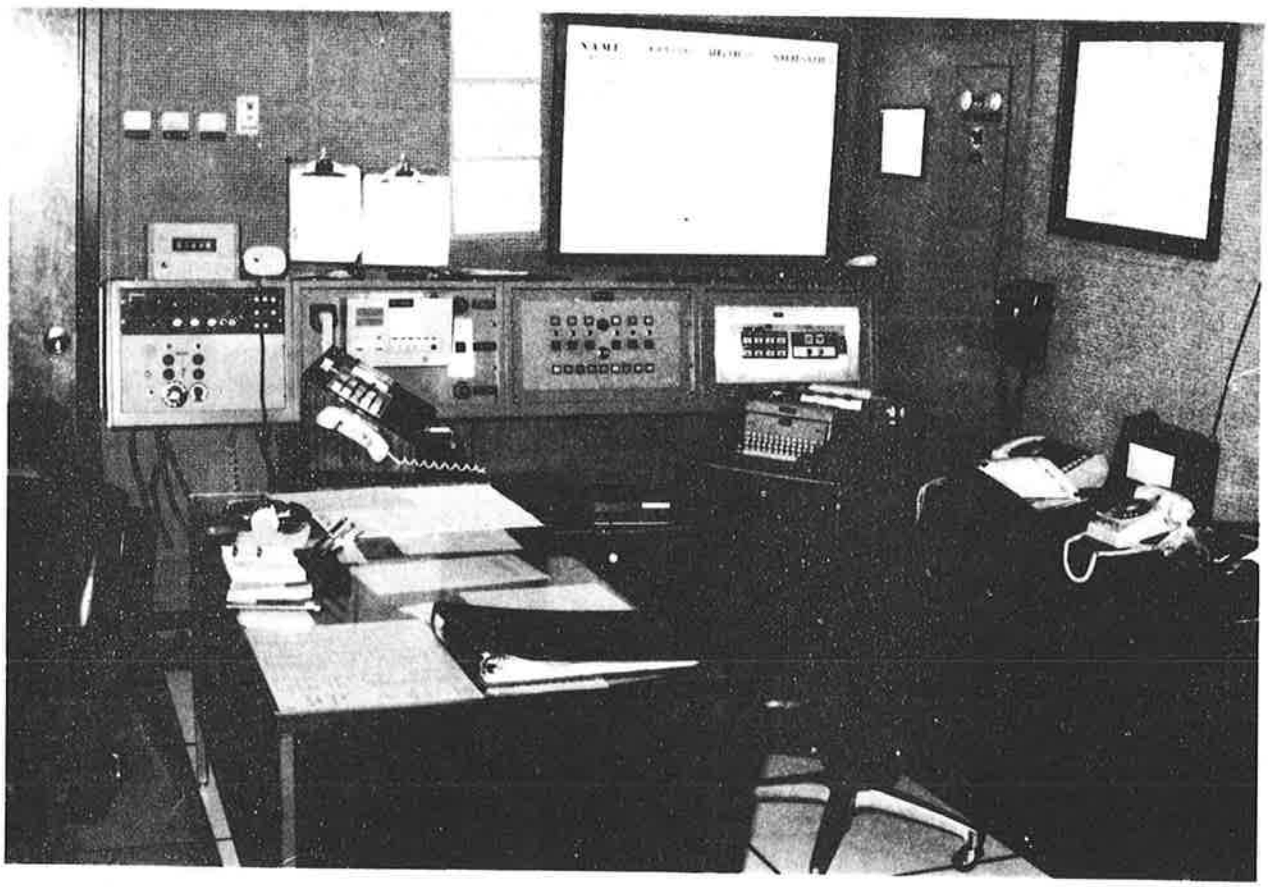


FIGURE 5-8. ASSISTANT CHIEF'S WORK AREA SHOWING LOCATION OF NOTAM CLIPBOARD

6. WEATHER

The Hartsfield-Atlanta Tower receives weather information from the Center Weather Service Unit (CWSU) at the Air Route Traffic Control Center (ARTCC) in Hampton, Georgia; the Weather Service Forecasting Office (WSFO) in Atlanta; pilots aloft; its satellite airports; and its own on-site weather sensors. The communication facilities linking these facilities to the tower are represented in Figure 6-1 and include the flight data entry and printout system (FDEP), electrowriters, FAA radio, and telephone lines.

The CWSU transmits its weather information to the tower on the FDEP in General Information (GI) messages. These messages are printed simultaneously on printers located in the cab and TRACON of the ATL tower and in the tower at Charlie Brown Airport. As shown in Table 6-1, special GI messages are sent as Meteorological Impact Statements, Center Weather Advisories (CWAS, SIGMETs, and convective SIGMETs. The Meteorological Impact Statements provide a general overview of weather in the Center area for the day. Although they appear to have no specific use by the controllers, they provide them with information on what to expect for the day and how the weather will affect traffic flow throughout the control center area. The information seems more immediately useful for the ARTCC but the tower controllers do like to have it. These are issued center-wide in the morning and may be updated as changes in the weather occur. There appears to be no specified procedure for distributing these messages to the tower controllers.

Center Weather Advisories are updates of the daily Meteorological Impact Statement and may be issued to specific sectors of the center-controlled area. All CWAs observed in the ATL tower were concerned with the development and progression of thunderstorm activity. Depending upon the time of year, 7 or 8 of these may be received in a 24-hour period.

SIGMETs and convective SIGMETs received in the ATL tower

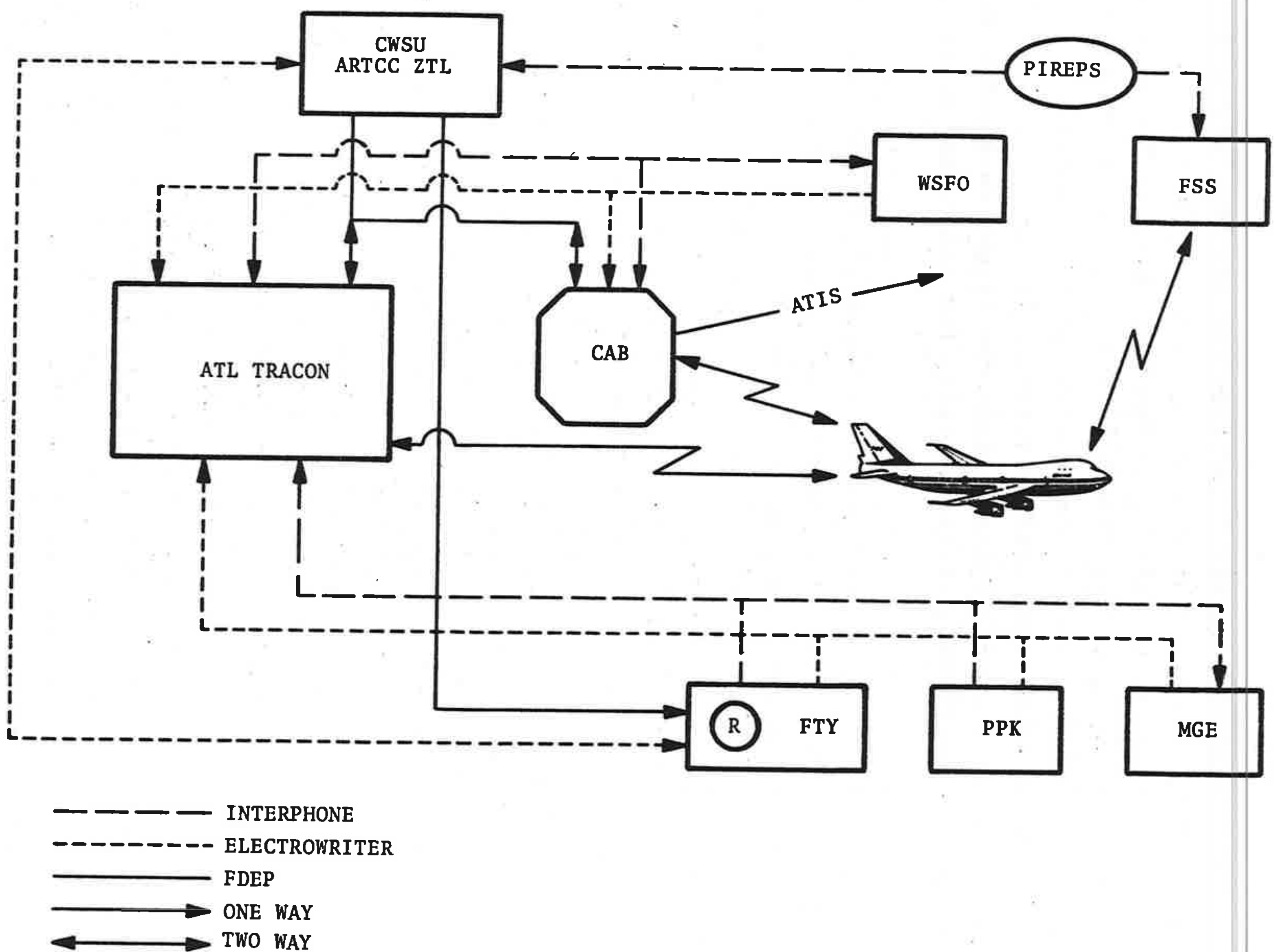


FIGURE 6-1. WEATHER INFORMATION SERVICES AND COMMUNICATION LINKS TO ATL TOWER

TABLE 6-1. SELECTED CATEGORIES OF WEATHER INFORMATION TRANSMITTED TO ATL TOWER

WEATHER MESSAGES	CONTENTS	SOURCE	EQUIPMENT	TIMELY?	FREQUENCY	USEFUL TO CONTROLLER	KEY POSITIONS	COMMENTS
CENTRAL WEATHER ADVISORY	WEATHER REPORT ALERTS, MAY BE SECTOR SPECIFIC, ALERTS TO SPECIFIC WEATHER CONDITIONS, USUALLY THUNDERSTORMS AT ATL.	CWSU	FDEP	NO	AS REQUIRED	NO	AC	TO ENSURE TIMELINESS OF INFORMATION CMWU TELEPHONES ASS'T. CHIEF WITH CRITICAL INFORMATION
METEOROLOGICAL IMPACT STATEMENTS	GENERAL CENTERWIDE WEATHER REPORT	CWSU		YES	DAILY IN THE MORNING WITH UPDATES	YES	AC	NOT USED DIRECTLY, BUT CONTROLLERS LIKE THE INFORMATION
SIGMET (WS)	WEATHER HAZARDOUS TO ALL AIRCRAFT, USUALLY THUNDERSTORMS	CWSU		NO	VARIES WITH SEASON	NO	TS	BY REGULATION, MUST BE BROADCAST
CONVECTIVE SIGMET (WST)	THUNDERSTORM ACTIVITY	CWSU		NO		NO	TS	
SURFACE AVIATION (SR) WEATHER REPORTS	CEILING, VISIBILITY, TEMPERATURE, DEW POINT, WIND DIRECTION & SPEED, ALTIMETER, ETC.	WSFO	ELECTRO-WRITER	YES	HOURLY	YES	TAR-2,3 AR-1,2 LC-1, 2,3 GC-1, 2,3 CD, TS	RECEIVED WITHIN MINUTES OF OBSERVATION, USED WHEN ATIS NOT HEARD BY PILOT
SPECIAL SURFACE (SP) AVIATION WEATHER REPORTS	UPDATES OF SR	WSFO		YES	AS REQUIRED	YES		RECEIVED WITHIN MINUTES OF OBSERVATION
AVIATION TERMINAL FORECAST (FT)	FORECAST FOR 24 HOURS FOR AREA WITHIN 5 MILES OF TOWER	WSFO			NOT RECEIVED ON A REGULAR BASIS AT ATL.	NO	TS	REDUNDANT AND LATE. INFORMATION OBTAINED BY AC AT START OF WATCH
WIND AND TEMPERATURE ALOFT (FD)	WIND AND TEMP. AT 9 STANDARD ELEVATIONS	WSFO				YES	TS	NOT NECESSARY, EXCEPT DURING WINTER
STORM DETECTION REPORTS (SD)		WSFO				NO	TS	NOT NECESSARY, CAN BE SEEN ON ASR
PIREPS		PILOTS	FAA RADIO	YES	AS REQUESTED	RARELY	DR	APPEAR LATER ON FDEP WHEN INFORMATION NO LONGER USEFUL
SATELLITE WEATHER REPORTS	ALTIMETER, WIND, CEILING, VISIBILITY, RUNWAY CONDITIONS	PDK FTY MGE	ELECTRO-WRITER	ON TIME	HOURLY	YES	SAT-2,3 DR-2,3	

usually reporting thunderstorm activity. Controllers have little use for these reports because the requirement to broadcast these messages increases controller workload, the messages usually pertain to geographical areas outside the sector, and they are usually late. In addition, this information is routinely conveyed to the pilots by their company dispatcher (for air carriers) or by the FSS (for general aviation). The AH-3 controller usually broadcasts each message over the FAA emergency frequency as time permits. Occasionally the SIGMETs come so fast that they cannot all be announced. When they are broadcast, the time is written on the back of the FDEP strip and that strip is filed with the assistant chief. When there is weather in the local area such as a line of thunderstorms the CWSU usually calls the assistant chief as soon as it is detected. If it is within 5 miles of the tower it will be detected on the BRITE. Notification of the storm will also be sent by FDEP, but by the time it gets to the tower the information will be late and the storm will probably have passed through.

A sample GI report of a convective SIGMET is shown in Figure 6-2. GI messages are always printed in contraction code and so are not easily read by all controllers. The controllers often do not have the spare time to check on the meaning of unknown code words, so some messages may not be understood in their entirety and consequently may not be broadcast. If the controllers need clarification of reports, they can contact the CWSU either using the FDEP or by telephone. Since the FDEP at Charlie Brown only receives, all queries from that tower to the CWSU must be done by telephone.

The message which is illustrated indicates the following:

It is from the National Severe Storm Forecasting Center at Kansas City (MKC) and is the second issuance of a convective SIGMET during this day and east of 87° west longitude (ZE). It is applicable to Virginia (VA) and North Carolina (NC), and extends from 40 nautical miles southeast (40SE) of Beckley, West Virginia (BKW) to 30 nautical miles south (30S)

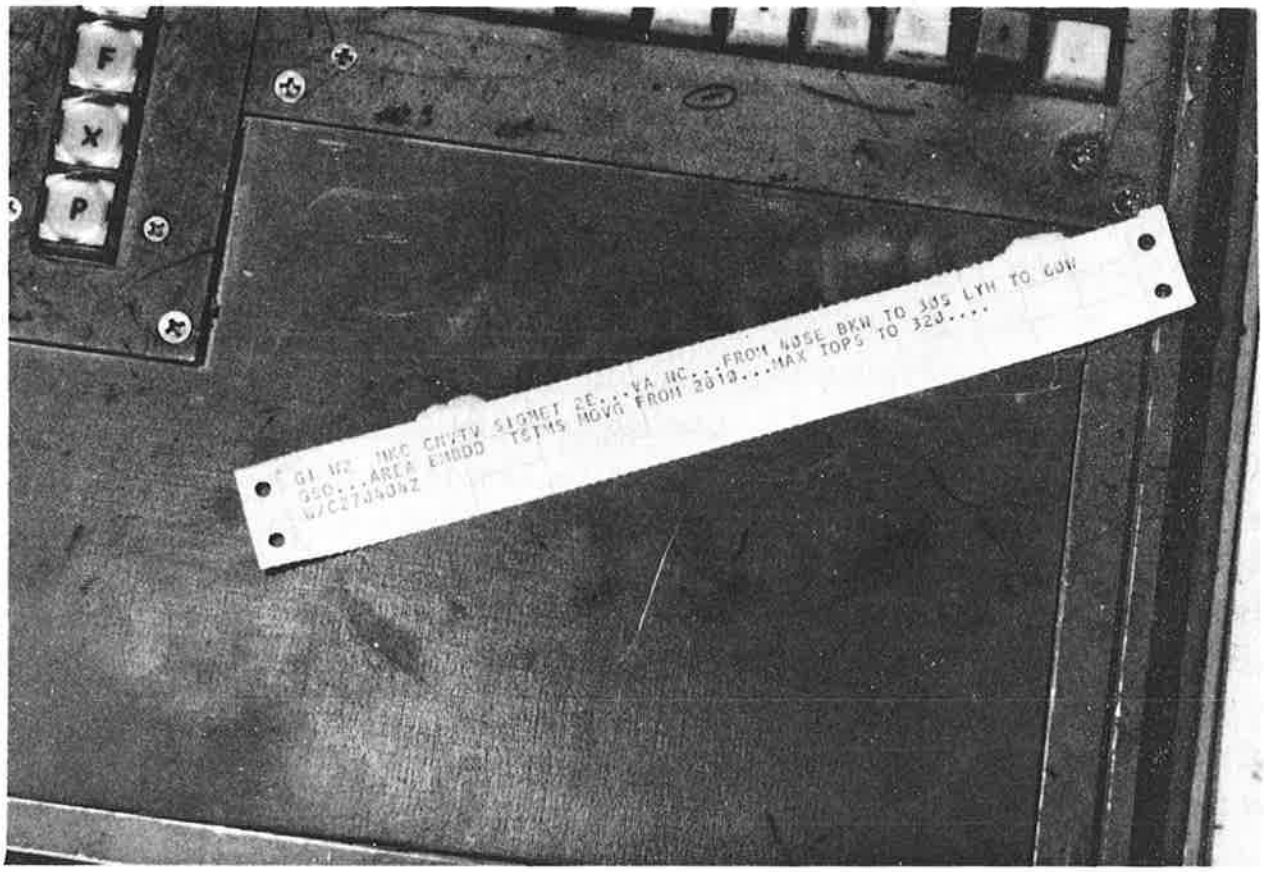


FIGURE 6-2. GENERAL INFORMATION WEATHER MESSAGE STRIP FROM CWSU BY FDEP

of Lynchburg, Virginia (LYH), to 60 nautical miles west (60W) of Greensboro, North Carolina (GSO). These embedded thunderstorms (EMBDD TSTMS) are moving from 280° at a speed of 10 knots (2810). The highest point of the storm (MAX TOPS) is up to 32,000 ft. (320). The observation was made on the 27th at 0404 hours Greenwich time (W/C 27040Z).

Weather information arriving from the CWSU over the FDEP is handled similarly in the cab and TRACON - it usually goes directly from the FDEP operator to his supervisor for distribution. In the cab, the GI reports are detected by the clearance delivery controller who tears them off the printer and gives them to the team supervisor. The supervisor reads them and then passes the information orally to the controllers who may need the information for pilot advisories. The strips are then informally put aside on the shelf of the GC-1 position where they can be read by anyone who wishes to do so. In the TRACON the FDEP messages are received by AH-2 and AH-3 (see Figure 6-3) and handed to the north and south arrival supervisors. Usually the supervisor on the departure wall retrieves the messages himself from the satellite FDEP. During the mid-shift all weather messages coming in on the FDEP system come in on a fourth FDEP printer located at the DH-2 position. The other three printers are deactivated for this shift. The supervisors read the messages and then advise their controllers of the weather which is critical to their operations. The location of equipment used to receive weather information in the tower is shown in Figure 6-3.

The National Weather Service Forecasting Office is located about 1-1/2 miles from the tower. It issues Surface Aviation Reports, reports hourly and Special Surface Aviation Reports (SP) within the hour as updates to the hourly message as required. These reports are printed out simultaneously by electrowriters located in the cab and TRACON in the message form shown in Figure 6-4.

Note the following with regard to these messages:

o Observation times and transmission times are nearly the

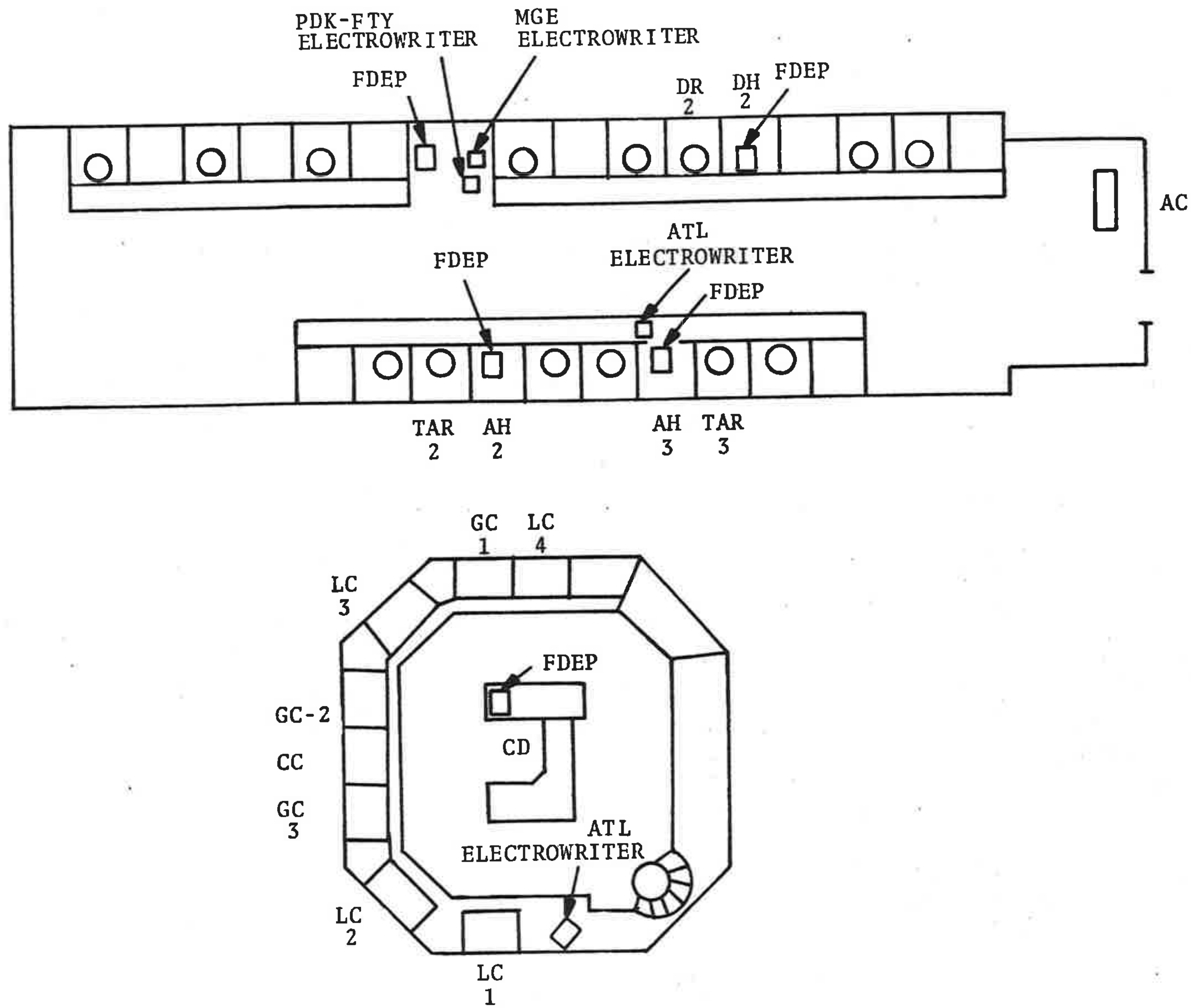


FIGURE 6-3. TRACON AND CAB FLOOR PLAN SHOWING LOCATIONS OF WEATHER COMMUNICATIONS EQUIPMENT

E R

ATL RS 1956Z
M4V OVC 1½ R+F
068/58/58/3110/976/
CIG 3V5
04/1957Z OBS

F S

ATL SP 2030Z
M10V OVC 6R-F
3110/977/CIG 8V12
04/2030Z OBS

G T

ATL SP 2041Z
M3BKN 10 OVC
1½R-F 3408/976
OBS 04/2042Z

FIGURE 6-4. CONSECUTIVE RS AND SP WEATHER MESSAGES FROM WSFO TO ATL TOWER BY ELECTROWRITER same.

o Sizable changes in ceiling and visibility are indicated.

o The two SP updates were made within one hour.

The two updates were apparently required by the large variations in ceiling and visibility. These reports are used by the CD or team supervisor in the cab as the basis for ATIS updates. As can be seen by the different ATIS codes on the three reports, each SP was accompanied by updates of both arrival and departure ATIS recordings. Depending on the information in the SP, the ATIS recordings may or may not have to be updated. Letters A-M are used as codes for the arrival recordings and N-Z are used as codes for the departure recordings.

The locations of the electrowriters are shown in Figure 6-3. Although, in the cab, it is technically the clearance delivery controller's responsibility to retrieve the electrowriter messages, the team supervisor usually does this because the clearance delivery controller cannot see when a new message has arrived. If the message does not indicate weather significantly different than that currently on the ATIS, no changes in that recording are made.

Clearance Delivery is informed by the supervisor of the new arrival ATIS code letter and the WSFO altimeter reading so that he can enter them into the ARTS system. When entered, this information is shown on all ARTS displays in the tower. The letter for the departure ATIS is only used in tower by Clearance Delivery and is only shown on electrowriter messages selected for ATIS recordings. Except when the weather is unstable, the controllers prefer to use the WSFO altimeter setting for issuance to pilots rather than the value on their console displays, because the former agrees with the one on the ATIS recording. Wind information is usually taken from the LLWSAS display as the ATIS wind is not displayed in the tower.

Whether transferred to the ATIS recording or just read for information, the electrowriter message in the cab is left lying next to the machine until it is discarded, it is never posted. If the information is of special relevance to the operations of a particular controller, the TS may hand him the written record. Special notes on weather are rarely prepared unless an important weather condition is expected to carry over to a following watch.

The same WSFO messages come into the TRACON on the electrowriter at the Arrival Handoff-3 position. These are posted at the TAR-3 position (Figure 6-5) beside him. Under conditions of rapidly changing weather, the team supervisor may make a second copy of the message to be posted at the other active TAR position. If the weather is changing within a radius of 40 miles, Arrival Radar may also get notes, but usually these controllers are just informed verbally so that they can relay the information to their pilots. Notes on weather, other than the actual electrowriter copy, are rarely found posted in the TRACON.

The WSFO also uses the electrowriter to issue Aviation Terminal Forecasts (FT) Wind and Temperature Aloft (FD) and Storm Detection (SD) reports. These reports, however, are rarely issued to the ATL tower.

The Aviation Terminal Forecasts Winds and Temperature Aloft and Storm Detection reports issued by the WSFO were felt to be unnecessary. At the beginning of each 8-hour watch the assistant chief calls the FSS or the CWSU to get weather forecast for his watch. Because of the shorter time period covered by the resulting report, it is much more timely and accurate than the 24-hour FT's. Except in winter, information in the FD reports is of little interest to the tower. When storm information is of interest, such as just after a storm front has passed, it is useful for only a short period of time and is gotten by the team supervisor or approach control by direct telephone call to ARTCC. The SD's are not required either, because storms close enough to be of interest, i.e., within 5 miles of the tower, can be detected on the controllers' display.

As indicated most of the weather information coming into the tower comes to the team supervisors. They then screen the information and pass what is useful on to the relevant controllers who

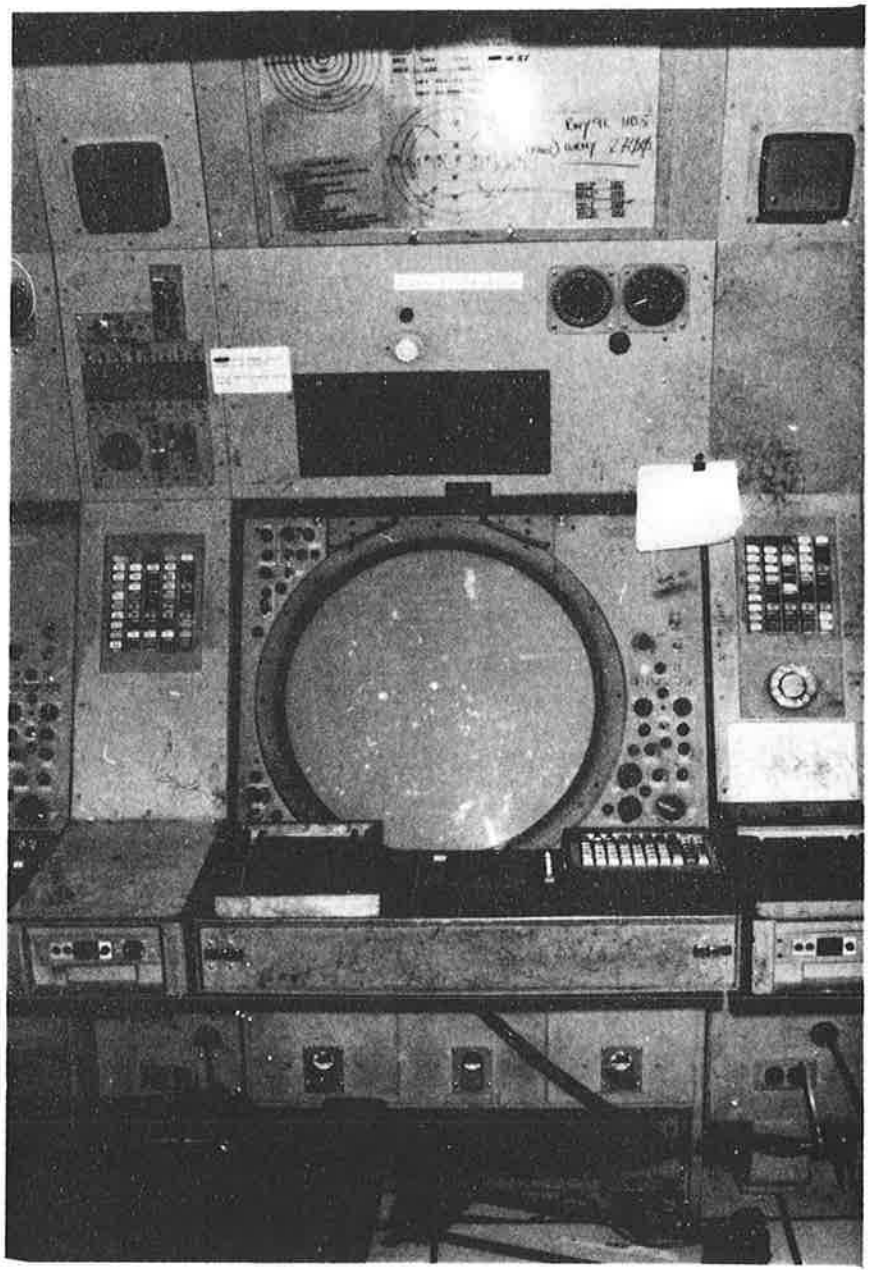


FIGURE 6-5. TAR-3 CONSOLE SHOWING LOCATION
OF POSTED WSFO WEATHER MESSAGE

use the information for pilot advisories or in re-routing them

The supervisors do not see all the weather information coming into the tower. Both the Center and satellite airports call TRACON controllers directly by telephone to discuss the status of storms. For example, the Center calls departure controllers to rearrange plane routing to avoid thunderstorms, or to advise approach controllers of weather over ATL arrival fixes and often the Center calls the wrong controller. For example, the Center may call Departure Radar with information on low level weather that is of interest only to satellite controllers. Sometimes this information is also transmitted later as, for example in a CWA; when the information is no longer useful.

Pilot reports (PIREPs) provide information on cloud tops, icing, and turbulence; but these only occur during the thunderstorm season between May and October. Then they are most often obtained by a TRACON controller from a departing plane at the specific request of the Flight Service Station (FSS) that posts it on the ATL VOR. PIREPs, whether spontaneous or requested, are supposed to be forwarded to the FSS for further dissemination. However, the spontaneous reports are often not forwarded, particularly if the weather being reported is within 5 miles of the tower and likely to dissipate quickly.

Two of the satellite airports with towers - Dobbins (MGE), Charlie Brown (FTY) - send reports to the Atlanta TRACON every hour, 24 hours a day on the two electrowriters shown at the end of the satellite wall in Figure 6-3 and 6-6; and Peach Tree (PDK) sends hourly messages between 6:00 am and 11:00 pm of each day.

FTY. The reports include: ceiling, visibility, temperature, wind information, and NOTAMs. Although technically it is the responsibility of SATH-2 to update satellite weather status, usually the team supervisor of the departure wall (he also serves the satellite positions) retrieves these weather messages as they are generated and passes them to the controllers responsible for the generating facility - SAT-2 is handed the messages from FTY

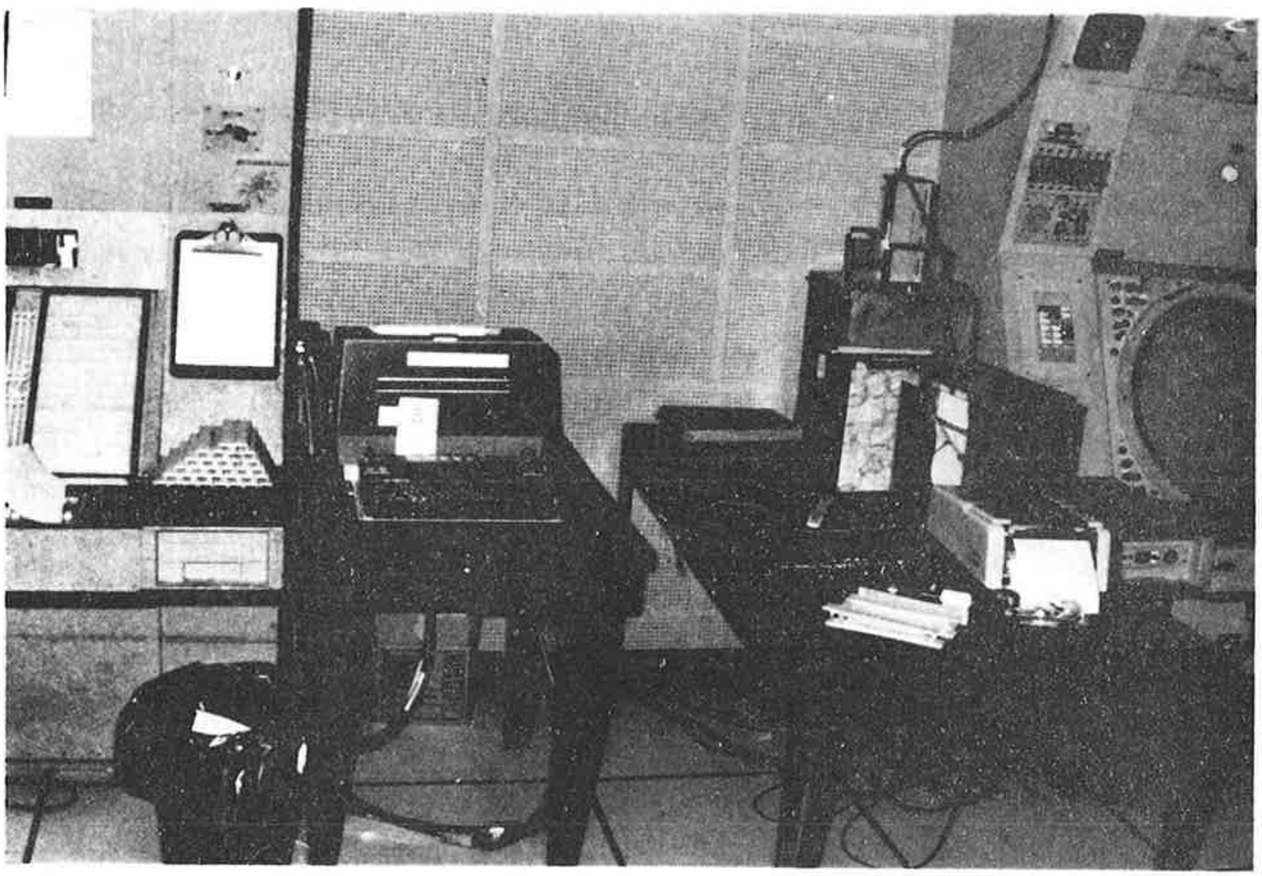


FIGURE 6-6. FDEP AND SATELLITE ELECTROWRITERS IN EQUIPMENT AREA NEXT TO SATELLITE WALL IN ATL TRACON

and MGE and SAT-1 gets the messages from PDK. Clipboards are available for posting the satellite messages (Figure 6-7) and occasionally they are used for this purpose (Figure 6-8). But, usually the messages are just left on the table of the console (Figure 6-9.) where the controller can read them more easily just by looking down at them.

During the mid-shift when all TRACON positions are consolidated to DR-3 and DR-2, all weather messages are "posted" at those locations (Figure 6-9). The satellite airport controllers (SAT-1, 2, 3), and Departure Radar (DR-2, 3) during the mid-shift, assist IFR flights into the satellite airports. In the absence of ATIS recordings for these airports DR provides them with weather information and NOTAMs issued on the satellite electrowriters. Aircraft landing at airports not providing weather information are given ATL weather at the pilot's request.

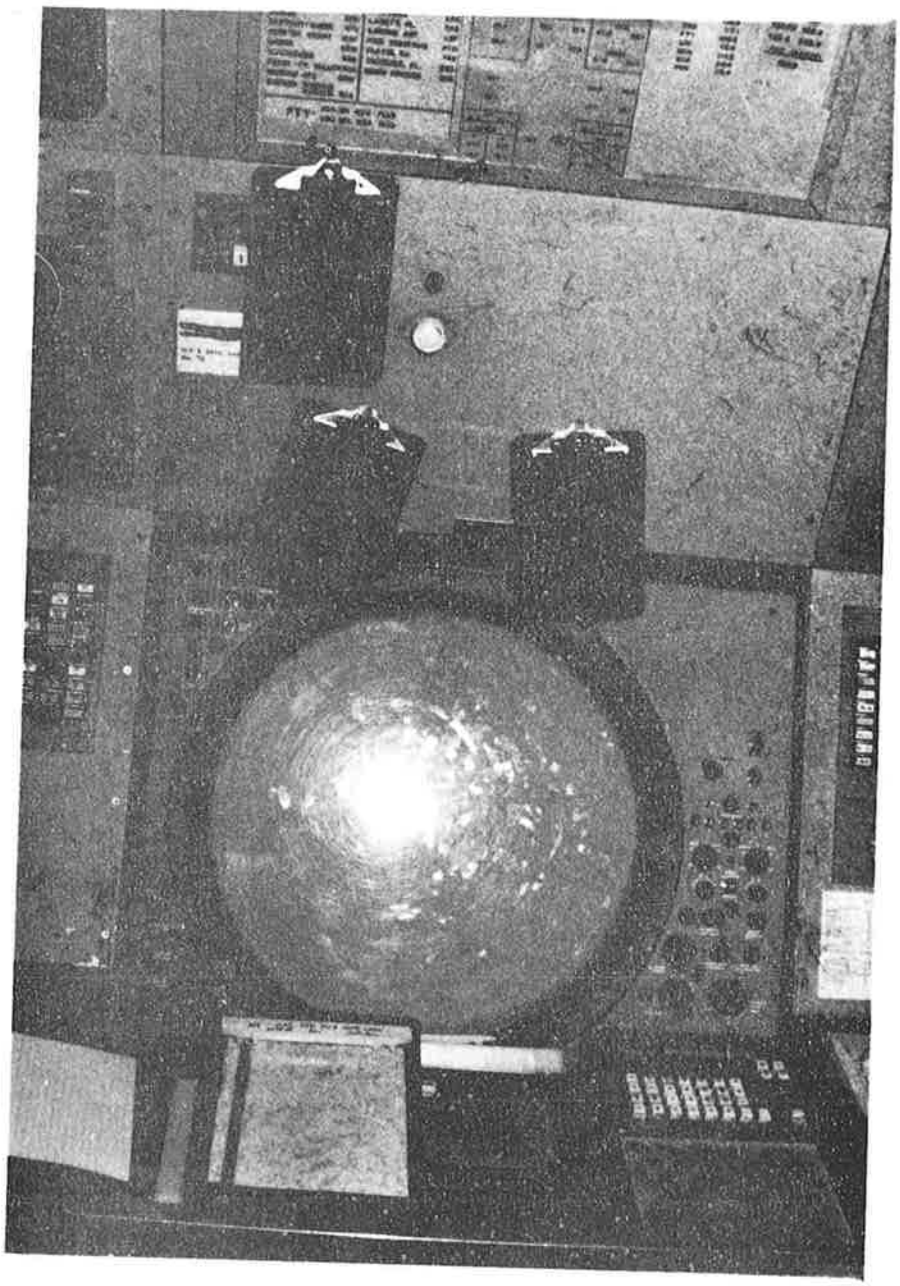


FIGURE 6-7. SAT-1 CONSOLE SHOWING WEATHER MESSAGE CLIPBOARDS IN STORAGE DURING MID-SHIFT

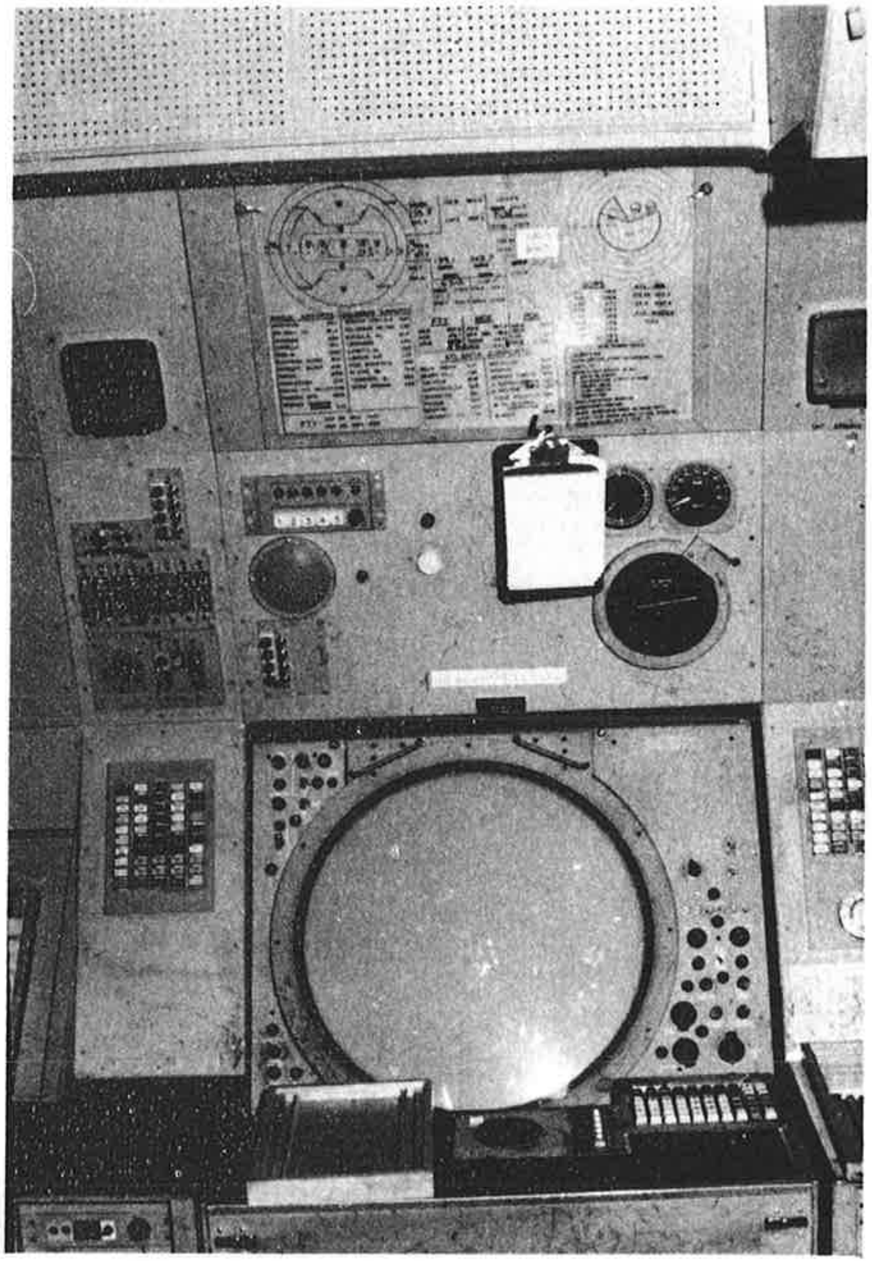


FIGURE 6-8. SAT-2 CONSOLE SHOWING WEATHER MESSAGE POSTED FOR CONTROLLER REFERENCE

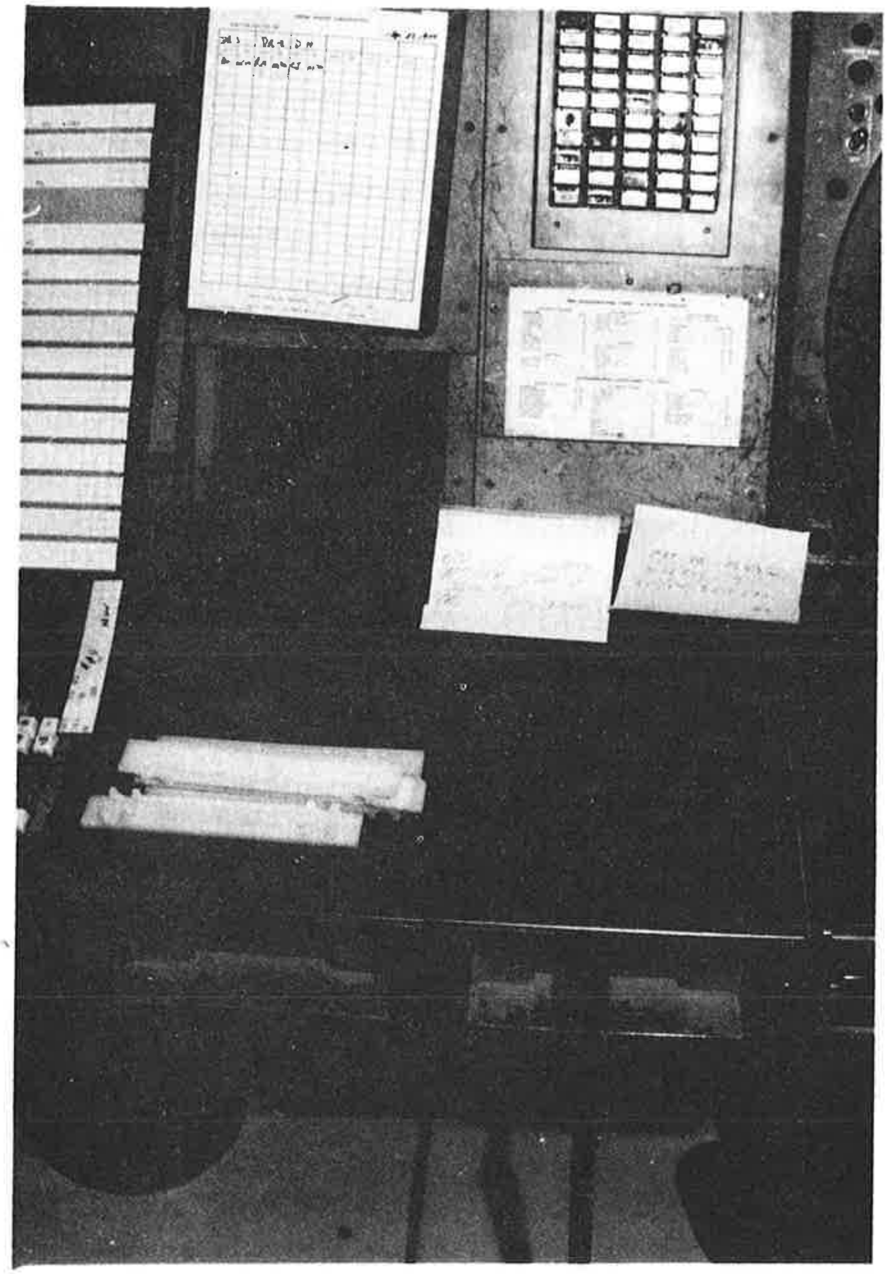


FIGURE 6-9. ATL AND FTY WEATHER REPORTS AT DR-3 POSITION DURING MID-SHIFT

SUMMARY

Most of the off-site weather information coming into the tower is from the CWSU and the WSFO over the FDEP and the electro-writer respectively. Usually this information is reviewed by team supervisors who distribute it to the particular controllers having an operational need for it. With the exception of the hourly surface avaiation reports and the special report update coming from the WSFO, much of the information arriving from these sources in "formal" message format is either late or superfluous. When weather information critical to the Tower operations must be transmitted to the tower from the Center, it is often done by telephone; thus assuring its timeliness. If the Tower has specific weather requirements, it is obtained by a direct telephone call to the WSFO or CWSO. Therefore, in spite of the lack of specificity and tardiness limitations of the formal system for distributing weather information to the controllers, they appear able to obtain all the weather data that they need to do their work. The most common complaint was not that they did not have enough information, but that they had a surfeit of information which was not useful because it was late or did not relate to the airspace that the controller was interested in.

7. CONSOLIDATED CAB DISPLAY DESIGN

This section presents a preliminary design of the Consolidated Cab Display (CCD) controller/supervisor interfaces. The designs are based upon requirements as determined by the operations analysis presented in previous sections and the Consolidated Cab Display/Remote Maintenance Monitor System (CCD/RMMS) Engineering Requirement (FAA-ER-500-007/1). The Engineering Requirement (ER) is a detailed specification for the CCD system. Rather than repeat much of the specification in this report, the specification is referred to and some familiarity with the specification on the readers part is assumed.

The section begins with an overview of the various devices which can be provided to the controllers and supervisors. Then each device is discussed in detail in Subsections 7.2 through 7.6. Each subsection consists of two parts (1) a description of the preliminary design, and (2) a list of issues which may impact on the operational acceptance of the design and assumptions which were required beyond the information given in the specification in order to complete the design. Each device is described without regard for its assignment in the Cab or TRACON. The assignment of devices is treated in Subsection 7.7. The assignments are then used in Section 9 of the report to investigate installation and integration issues which may result when the devices are installed along with TIPS.

7.1 EQUIPMENT OVERVIEW

The CCD will provide five different types of interface devices for controller/supervisor use. These interfaces will be driven by and will communicate with the CCD computer. A summary of each type of device follows. Details are given in subsequent sections.

(1) Critical Display (CRD) - This display is intended to consolidate most operational displays now used in the Cab. These displays include the digital clock, altimeter setting indicator, centerfield wind displays, Runway

Visual Range (RVR) displays, and the Low Level Wind Shear Alert System (LLWSAS) display. The unit is composed of 7-segment and 16-segment incandescent indicators of various sizes. These indicators will assure easy viewing (high contrast) in the high ambient light of the Cab. The CRD is shown to scale in Figure 7.1-1. Each incandescent indicator location is shown; although in operation with no filaments lighted, the panel will appear as a single black face.

(2) Supplementary Display (SD) - This display is intended to provide certain auxiliary information to the cab controllers. Information will include the status of local equipment such as the ILS and ALS, and local weather information. The unit is composed of a bright 9-inch (diagonal) Cathode Ray Tube (CRT) and twelve page-select buttons. The controller will use the buttons to select whichever page of information he desires. The SD is shown to scale in Figure 7.1-2.

(3) Lighting Control Panel (LCP) - This control panel is intended to consolidate the control panels associated with runway lighting. These controls include control of the Approach Lighting System (ALS), Sequence Flasher Lights (SFL), runway edge and centerline lights, and touchdown zone lights. The panel will allow selection (on-off control) and intensity setting for each device controlled. The panel is shown to scale in Figure 7.1-3. The large buttons consist of rear projection multi-legend illuminated indicators permitting unique legends for each device controlled. Along the bottom are momentary push buttons for use in light intensity selection.

(4) Supervisory/Maintenance Display (SMD) - This unit will consist of a bright 12-inch (diagonal) CRT and a full ASCII keyboard with a numerical keypack, cursor control, and edit key functions. A unit will be placed in the cab and in the TRACON for use by supervisory personnel

in controlling and monitoring the CCD system.

(5) TRACON Display (TD) - This display is essentially the integration of the CRD and SD for TRACON use. The first four lines of the unit will consolidate most data displays now in the TRACON including the digital clock, altimeter setting indicator, centerfield wind displays, and RVR displays. The last twelve lines will present auxiliary information. While the first four lines will be fixed, the last twelve lines will be controller selectable via twelve page-select buttons. The unit is shown to scale in Figure 7.1-4. The unit will be composed of a dot matrix planar gas discharge panel along with the associated controls and page-select buttons. The gas will be such that the characters appear green in color.

7.2 CRITICAL DISPLAY DESIGN AND COMMENTS

7.2.1 Format

The basic format for the CRD is shown in Figure 7.2-1. Of course, for the actual system the characters would be the orange incandescent filaments on a black background rather than the black on white characters as shown. On the basic format line 1 provides time (01 hours, 57 minutes, 32 seconds, Zulu), altimeter setting (29.77 inches of mercury), centerfield wind (bearing 310 degrees with average winds of 7 knots gusting to 9 knots), and arrival ATIS code (November). The ATIS code is manually entered at the SMD. The supervisor would enter ED, ATIS and strike the carriage return. The computer would prompt the supervisor by writing either ATIS, = N with N being the current ATIS or ATIS, currently undefined = _ if there is no ATIS in effect. The supervisor simply enters the new ATIS code and strikes carriage return. If a sensor based quantity such as centerfield wind were in error due to sensor failure, values for these quantities may also be entered manually by the supervisor in a manner similar to entering ATIS. On line 1, a light green tint is placed over the altimeter setting and centerfield wind gusts to seperate the items and aid readability.

Lines 2, 3, and 4 provide data on three specified runways. Only two runways, 9R and 8, were chosen for this example although any runway (and associated data) may be assigned to any of lines 2 through 4 of any CRD from the SMD. The runways can be assigned in two ways as follows:

(1) The supervisor enters AR, 9R, LC2, 1 to assign runway (AR) 9R to the Local Control 2 (LC2) display on line 1 of the three available lines.

(2) Runway assignments can be made ahead of time for each display and associated with a runway configuration. Then assignment of the configuration assigns runways to all three lines of all CRD'S. To assign the "West" configuration the supervisor would simply enter CR, WEST.

The data associated with each of lines 2 through 4 begin with the runway identifier in the first three characters (e.g., blank 9R). This is followed by a single character giving the Vortex Advisory System (VAS) inter-arrival separation indication, a "3" for three mile separation on all aircraft or a "6" for the current separation standards. The VAS indicator is tinted light green to aid readability. The VAS indicator also carries an alarm. When the VAS value changes, either from "3" to "6" or "6" to "3", an audible alarm will sound and the character will start to blink. The audible alarm is not continuous but consists of two half-second tones separated by a half-second space. The controller is then expected to push the acknowledge button (labelled "ACK" on the CRD) at which time the VAS indicator will stop blinking. This clearing of the visual alert (i.e., blinking) is important since other alerts will be presented on the CRD and if several items are blinking it will not be immediately obvious which item caused the audible alarm.

The four characters following the VAS indicator are used to present equipment status information. Status will cover the ALS, SFL, and ILS systems. The data available to provide this status are defined in Table 7.2-1. A set of displayed variables is defined from this table in accordance with the CCD specification and is presented in Table 7.2-2. As a status change associated with a runway occurs (e.g., 9R drops from CT3, to CT2) an audible cue sounds and the new status message blinks. The audible cue is momentary like the VAS alarm and the controller is expected to strike the acknowledge button to stop the message from blinking. If there is no status message in effect for the runway, the new status message will be displayed in the three characters following the VAS indicator. This is shown in Figure 7.2-2 for the "CT2" indicator for runway 9R. However, if there is already a status message for the runway, the new message will be displayed on line 5 of the display, and a continuation symbol will be placed on line 5 ahead of the message and in the fourth space following the VAS character to indicate which runway the continued message applies to. This is shown in Figure 7.2-3 for the ALS and SFL alarms for runway 9R. When the alarm condition is cleared up the associated message will be eliminated from the display with no audible cue. This will occur whether or not the alarm has been acknowledged.

The next three groups of five characters each are used to display Runway Visual Range (RVR). Taken from left to right the three groups present touch down, mid range, and roll out RVR. Atlanta currently has five RVR sensors, which are used as shown in Table 7.2-3. For each RVR group, the first three characters represent the RVR reading in tens of feet. The last character denotes increasing (I), descreasing (D), or no change (O) in RVR reading. The next to the last displayed character may be zero representing the units digit of the RVR, or the RVR system status in accordance with Table 7.2-4.

Each RVR has an alarm feature. The controller can set in an RVR reading and an alarm will occur when the RVR value becomes less than the alarm setting. On the CRD the alarm setting is made with the subminiature momentary switches to the left of the display face (see Figure 7.1-1). There is a switch and alarm setting indicator for each of the nine RVR reading groups. The alarm setting is in hundreds of feet. To increase the setting, the switch is moved to the right and the setting increments upward until the switch is released. To decrease the setting, the switch is moved to the left. When the RVR drops below the alarm setting an audible cue (i.e., two half-second tones) sounds. However, unlike the previous alarms (i.e., VAS and status), there will be no character blinking for a continuing visual alert.

The last two characters on each runway associated line indicates the current ALS intensity setting with zero indicating the ALS is not turned on. The first of the two characters is fixed as an "S". The second characters is the intensity level, with level 5 shown in Figure 7.2-1. The two characters are tinted green to improve readability.

Lines 6 and 7 of the CRD are dedicated to the LLWSAS system. Beside each line is an alternate action button (see Figure 7.1-1) which, in the first state, will cause the boundary winds associated with that line to be displayed. In Figure 7.2-4 the display is shown as if both buttons where calling for the boundary winds. There are five boundary winds in all, three on line 6 and two on line 7. For each wind, the two leading characters give the sensor location and are tinted green to aid display readibility. These locations are defined for Atlanta in Section 3. The following five characters give the wind direction and speed (e.g., 310 degrees at 9 knots for the South West boundary wind in Figure 7.2-4).

When the LLWSAS buttons are in the second state the boundary winds will not be displayed unless they are in an alarm condition. The alarm condition is that the vector difference between a boundary wind and the centerfield wind exceeds a prescribed value. When an alarm condition occurs an audible cue sounds (i.e., two half-second tones) and the boundary wind is displayed blinking. However, unlike the VAS and status alerts, striking the acknowledge button will not stop the blinking. This is because, if an alarm should occur when all boundary winds have been manually called for, the blinking is required to know which wind is in an alarm condition.

The last two lines of the CRD will present the local Atlanta weather as obtained from Service A. However, as can be seen from Table 7.2-5, not all available weather elements will be displayed. Sea level pressure is not used, and wind direction speed, character and altimeter setting is available in real time on the line 1 of the display. The weather message given in Figure 7.2-1 reads; Atlanta, Special Observation, 01 hours, 53 minutes Zulu time of observation, sky cover measured 300 ft. and variable, broken layer at 2500 ft., overcast, 1/2 mile visibility in rain and fog, 47 degrees temperature, 46 degrees dew point, ceiling is variable from 200 to 400 ft. The surface observations are normally provided hourly with special reports due to unusual conditions coming as appropriate. When a new message is received, an audible cue (two half-second tones) will occur and the weather message will blink until acknowledged.

7.2.2 Issues and Assumptions Made

1. The time in line 1 is unnecessarily confusing to read at a glance. Either seconds should be dropped or they should be presented with small characters.

2. There is room to add a second VAS character for departure separations but this would require physical/rewiring modifications to each panel. This is true of any small modification in format which points up the lack of flexibility inherent in this hardware approach versus a bright CRT. A bright CRT would permit format changes through software alone. Changes could be worked-up off-line, shown to controllers, and implemented in a matter of minutes.

3. There is a conflict in the specifications as to the nature of status alarms. In Section 1-20.3.7.10.2 of the specification, a continuous audible-until-acknowledged is specified but in Section 2-3.3.1.2.20 an audible cue as with the VAS indicator is called for. In this design, the audible cue is described.

4. Section 1-20.3.7.10-2 of the specification calls for status of the standby channels for application to the Category II operation. Atlanta has a special CAT III/ CAT II logic system which is used for this purpose and includes standby failure as well as other factors. Therefore, this design uses the CAT III/CAT II logic system and does not use the standby channel status, that being redundant.

5. Section 1-20.3.7.10.2 of the specification calls for out-of-service alarm functions on MALS. Runways 26 and 27L at Atlanta have MALS but, as seen from Table 7.2-1, there are no out-of-service alarm indicators. Controllers acquire this information from pilots by voice radio. These indicators could be entered manually from the SMD and displayed as status on the CRD. However, in this design, this status is handled via the SD (see Section 7.3).

6. When the runway configuration shifts from West to East and vice versa, there will be many CRD alarms. For example, if the 27L and 26 ILS interlocks are selected while the CRD is in the West configuration as shown in Figure 7.2-2, all individual elements of the 9R and 8 ILS system will alarm as shown in Figure 7.2-5 until the East CRD configuration is selected. If this becomes a serious complaint the ILS element (e.g., LOC) alarms may be able to be ANDed with the interlock selection to eliminate the problem. This was not included in this design since it involves a detailed analysis of the ILS monitor and interlock selector timing and the modification may not be required.

7. The ALS level-5 timer is not dealt with in the specification. In this design we have chosen to use the status alarm feature to provide this alarm. If this is found unacceptable and a timer alarm is required on the Light-

ing Control Panel it will have to be added.

8. The source for Table 7.2-1 is an Atlanta Facility List of Demarcation Terminals obtained from Airway Facilities. The terminals with "a" added to the identifier have been added since they were missing from the list, should be available, and were needed in the design.

9. The RVR display has been designed in accordance with Section 1-20.3.7.10.1 of the specification and in accordance with the direction to assume a series 500 system given in the Atlanta Facility List of Demarcation Terminals. However, based upon the current operation of the Atlanta RVR's given in Section 3 of this report, there appears to be some discrepency as to just what RVR system Atlanta has.

10. The CRD does not adopt a standard alarm technique and may confuse the controller. For example, if the LLWSAS has alarmed and the boundary wind is blinking, and an RVR audible cue sounds, that cue might be mistaken for a LLWSAS alarm. We suggest that a single alarm technique be applied to all alarms and that an RVR alarm be accompanied by the associated RVR value blinking until acknowledged. Further, unless the LLWSAS boundary winds have been manually selected for display, the acknowledge button should stop the boundary wind reading from blinking.

11. Due to the characters chosen for the ALS setting indication the "S" looks like the intensity level "5". We suggest the "S" be changed to an "A" for ALS setting to help avoid an error in reading the setting.

12. Atlanta weather from Service A may not be very useful within the Cab. The Atlanta weather is currently obtained from the local Weather Service Forecast Office (WSFO) via electrowriter almost immediately after the observation is made. The weather is used to update the ATIS (arrival and departure) as required. The new ATIS code and altimeter setting is entered into ARTS for display in the

TRACON and on the BRITE in the Cab. If the service A weather was timely it could replace the electrowriter as the source for ATIS. However, Service A weather will arrive at the CCD from 15 to 20 minutes after it is received in the cab by the electrowriter. This delay may cause problems.

Due to the delay the tower will likely continue to use the electrowriter weather to update ATIS, it being the most current information. Once a new ATIS is adopted, for the next 15 or 20 minutes the Atlanta weather on the CRD will be out-of-date and will not agree with the ATIS being broadcast. The controllers now desire and use the ATIS altimeter setting from the BRITE to judge the validity of ATIS using the altimeter setting instrument. The controllers will want to use the Atlanta weather message in much the same way. If the weather is not the current ATIS weather this could lead to unnecessary controller weather reports. In addition, pilots might complain over descrepencies between ATIS and controller weather reports. Such problems could lead to the controllers ignoring the Atlanta weather on the CRD.

One solution to the potential problem is to place a CCD remote data entry and display unit at the local WSFO. If this were done, the most recent Atlanta weather could be transmitted to the Cab using the CCD in place of the electrowriter. The Team Supervisor could use the data for ATIS and the data would be immediately available to the CRD. However, not all weather messages prompt a new ATIS. Therefore, the CCD system should allow the Team Supervisor to receive the new weather at the SMD, decide if a new ATIS was required, cut the new ATIS if necessary, add the new codes to the weather message from the keyboard, print the weather message in hard copy, and send the new weather message to the CRD's only if a new ATIS is cut. The two ATIS codes (Arrival and Departure) should appear on the CRD with the weather message; and altimeter setting, wind direction and speed should be retained in the weather message. If the latter two elements are retained the ATIS and altimeter setting need not be entered into ARTS and the controllers can use wind direction and speed along with their real time read outs to judge the acceptability of the current ATIS.

13. The Team Supervisor should receive the weather at the SMD on an Atlanta Weather Page. However, no provision is currently made in the CCD specification which will permit the Team Supervisor to edit the local Atlanta weather on an Atlanta Weather Page and then transmit, with a simple keying action, the weather to the CRD's. The Team Supervisor would have to enter the entire weather message onto the CRD manually.

    A special provision could be added to the CCD which would simplify the transmission of the Atlanta weather to the CRD's and provide a daily log of weather messages. This would be a general Weather Page onto which all processed messages would be listed. When a new message was added the SMD would alarm/alert the Team Supervisor. If the message was Atlanta weather the supervisor would decide if a new ATIS was required, cut the new ATIS, if necessary, add the ATIS codes to the weather message, and, with a simple keying action, send the edited Atlanta weather message to the CRD's. Only at day's end would the entire log be printed out in hard copy. If multiple pages were required they would be automatically provided by the computer from a list of available pages previously defined. A continuation statement refering the user to the next page would be used at the end of each page. Alarms/alerts at the SMD would list the page on which the new message has been added (not the first Weather Page).

14. If the two related ATIS codes, altimeter setting, and centerfield wind are added to the Atlanta weather message as suggested in Item 12, there will not be room to display the message on the two lines allocated. To add a third

line to the Critical Display requires a good deal of hardware alteration. However, it will subsequently be seen that a third line can be added to the Backup Critical Display Page of the Supplementary Display and the Critical Display Weather Page of the TRACON Display with only a software change. This like Item 2, points out the inherent limitation in the incandescent panel approach to the CRD versus a more flexible bright CRT approach.

7.3 SUPPLEMENTAL DISPLAY DESIGN AND COMMENTS

7.3.1 Formats

The Supplementary Display (SD) will provide twelve selectable pages of information. Each page will display 16 lines of 32 ASC II characters. Each character will be drawn in a 7 by 9 dot-matrix with a 7 by 1 cursor/underline available on each character. The characters will be 0.25 inches high.

The CCD specification calls out five specific pages of information to be provided. These pages are defined in Table 7.3-1. In addition, the CCD will process Service A messages and permit construction of weather pages. This study examines the five specific pages and the potential for weather pages. In addition, an additional set of Daily Record pages is discussed.

7.3.1.1 Specific Pages - The Backup Critical Display is shown full scale in Figure 7.3-1. The format is similar but not identical to the CRD. Of course, as with the CRD the characters on this page will be shown with bright characters (raster dots) on a dark CRT background rather than black on white as shown in the figure. The first line is a header line with the first 30 characters reserved for a page title. A good deal of space is available for the status information on each runway line (i.e., eleven characters versus four with the CRD) and, therefore, no overflow line like line 5 of the CRD is provided on the backup display. In addition, the LLWSAS boundary winds are always displayed on the backup display. They cannot be manually suppressed even in the unalarmed state as on the CRD. When status data and surface observation data, change, the changed data is highlighted (e.g., blinked) on the backup critical display until acknowledged on the SD. If a page other than the Backup Critical Display is being displayed on the SD, the page number of the Backup Critical Display will be displayed using two characters in the upper right hand corner of the SD (i.e., the last two characters of the header line) and will blink until the controller selects the page and then strikes the acknowledge button on the SD. If another alert takes place on another page before the Backup Critical Display alert is acknowledged, the Backup Critical Display page number will be replaced by the new alert's page number but will return when the new alert is acknowledged. This is the general procedure for alerts on the SD, whether or not they are accompanied by an SD alarm (i.e., two half-second tones at a different frequency from the CRD alarm).

The RVR Data Page is shown in Figure 7.3-2. The five RVR sensors are used to provide test alerts or alarms connected with this page.

The ILS Status Page is shown in Figure 7.3-3. The variable parameters of the format are defined with Figure 7.3-4 and the associated variable codes are given in Table 7.3-2. In Table 7.3-2 the items referred to are the items from the Status Lines Available, Table 7.2-1. This page provides all the status information which is currently on the ILS monitor panel and on the VOT-LOM monitor panel. Features of the format include:

(1) Arrow indicators with reversed video to permit quick identification of the systems selected via the interlock controls. Of course, the reversed video on the CRT will be black characters against a field of white raster dots rather than the white on black as shown in the example figure. Units on runways 9R and 8 are selected in the example format of Figure 7.3-3.

(2) Off indicators with reversed video to permit quick recognition of units which have inoperative elements but which are selected for service. The middle marker on runway 8 is in such a critical state in the example format of Figure 7.3-3.

(3) Monitor (MON), power and environment (PE), and abnormal (ABN) status indicators offset to the right to permit quick recognition of these indicators. The localizer on runway 9R is displaying a PE indicator in the example format of Figure 7.3-3.

The current ILS monitor panel provides an audible alarm whenever the status of a variable changes (e.g., the main channel of the localizer drops to standby). This information is relayed to the AF Maintenance Sector personnel from the Cab. Discussions with tower personnel at Atlanta indicate that if AF Maintenance Sector personnel had their own maintenance monitor panel (as they will have with the CCD) some of these alarms might not be needed or desired by the tower. The subset of alarms defined for the CRD in Table 7.2-2 might be adequate. Therefore, where the SD is installed at a station with a CRD, it is recommended that the ILS page not give audible alarms or visual alerts and the CRD be the sole source for ILS alarms/alerts. In this installation, the ILS page of the SD would only be used by the controller to give a broader picture of ILS status if needed. In this manner redundant alarms/alerts would be avoided.

If the Team Supervisor wishes to have the CRD type alarms/alerts but does not have a CRD located conveniently, he can receive these alarms/alerts on a Backup Critical Display Page (see Item 4 Section 7.3.2). If the Team Supervisor wishes to have the full set of ILS alarms as they are now on the monitor panel, a second ILS status page with alarms/alerts can be defined. Either the Backup Critical Display Page or the second ILS Status Page can be assigned to a SD for the Team Supervisor. The approach to defining the second ILS Status Page is discussed in Item 5 of Section 7.3.2.

In this design, the ALS/MALS Data Page and the Field Lighting Page have been integrated into a single Runway Lighting Page. An example page is shown in Figure 7.3-5. The variable parameters of the format are defined with Figure 7.3-6 and the associated variable codes are given in Table 7.3-3. All of the status information on field lighting available from the field equipment is on this page. This status includes ALS intensities, ALS alarms, SFL on/off indication, and SFL alarms. The other items are not field acquired status. Rather, they are simply what has been selected in the Cab (e.g., from the Lighting Control Panel). The field equipment may not have received the command or responded. There are no automatic status indicators for touch down zone, edge, centerline and MALS lighting systems or for the VASI. This status is currently obtained from the pilots by voice radio. The features of this format include:

(1) Off indicators with reversed video to permit quick recognition of the units which are not operational. The SFL for runway 9R has been turned off or has automatically tripped off in the example format of Figure 7.3-5.

(2) Alarm indicators offset to the right to permit quick recognition of the units in an alarm status. The ALS for runway 9R is shown with an alarm in Figure 7.3-5.

In keeping with the desire to avoid redundant alarms, it is recommended that where a CRD is present, the Runway Lighting Page of the associated SD not have any alarms/alerts associated with it. All relevent runway lighting alarms available to the CCD will be available via the CRD. The Runway Lighting Page will be available to the controller for obtaining a broad picture of lighting status. If the Team Supervisor wishes to have the CRD type alarms/alerts but does not have a conveniently located CRD, he can use a Backup Critical Display Page. He also has the option of setting up his own Runway Lighting Page with alarms/alerts on changes of any variables he chooses. This could be assigned to a Team Supervisor SD.

7.3.1.2 Service A/Weather Page(s) - The recommendations made regarding weather pages are based upon current weather data usage as described in Section 6. They do not consider changes which might take place with the introduction of an Advanced Weather System including Automated ATIS. The CCD prototype will have to work in the current Atlanta environment.

(1) The Surface Aviation Weather Observations (SA's) and Special Surface Aviation Weather Observations (SP's) for Atlanta should be displayed on the CRD as discussed in Section 7.2.

(2) SIGMETS and Convective SIGMETS should be available on a SD page. Although the information is considered old for controller use, regulations require that the tower "broadcast a SIGMET alert once on all frequencies". The SIGMET page need only be assigned to the controller(s) responsible for the broadcast. This may only be the AH-3 position in the TRACON at Atlanta in which case the Cab controllers would not get the SIGMET page and the page would go primarily to the AH-3 position in the TRACON on the TRACON Display (TD). The page would receive the new weather message which would simply replace the last message received. The Team Supervisor could print out each message in hard copy for a permanent record. With receipt of the new message, there would be an audible alarm and visual alert. The controller would acknowledge the alert after making the required broadcast.

No other weather data from Service A appears to be used now in the Atlanta tower. Other weather data potentially available via remote data entry and display terminals is discussed in Section 7.3.2.

7.3.1.3 Status and the Daily Log - There is much equipment whose status is not automatically acquired. Even the status on the ILS elements which is automatically acquired is only available while the elements are selected via the interlock switches. The status of the ILS elements, ALS, and SFL (i.e., whether they are available or not) is not known if the units are turned off. Most status information now comes to the tower personnel from pilots via voice radio (e.g., for VASI and MALS), from maintenance sector personnel, and from the airport operator. This status is formally logged for the tower (both Cab and TRACON) by the Assistant Chief in the TRACON on the Daily Record of Facility Operations (see Figure 5-1).

It is possible that some of the information in the daily record would be useful to have on the SD (in the Cab) and TD (in the TRACON). This can be provided with a Daily Log Page. Upon logging an outage, etc. on the daily record the Assistant Chief will determine whether or not the information is required by the controllers. This information would then be manually entered onto the Daily Log Page. Entry would cause an alarm (i.e., two half-second tones) at the SD and TD and a visual alert (i.e., the new entry would blink until acknowledged). If two pages were required added pages could be defined and assigned to available page select buttons. When the first page was filled, the last line entered would indicate that there was a continuation page and the page number. Subsequent entries would alarm/alert only on the continuation page. An example of a Daily Log Page is given in Figure 7.3-7. The entries in the example were selected from the Daily Record in Figure 5-1.

7.3.2 Issues and Assumptions Made

With regard to the Backup Critical Display:

(1) Although the specification does not depict separation between the line 1 data, there is room and in the formats shown we have chosen to provide such spacing to aid readability. In addition, colons have been added to aid the readability of time and centerfield wind.

(2) From Figure 7.2-5 it is apparent that even the eleven status characters are not sufficient to display the fact that the ILS for a selected runway has been turned off. A status overflow line may be warranted even on the

backup critical display.

(3) Since all five characters per RVR group are the same size, it may be necessary to change the "no change" code from 0 to a character which cannot be mistaken for a numeral of the RVR value.

(4) The specification calls for "highlighting" CRD alarms on the backup critical display until acknowledged on the SD. It is unclear as to whether or not this means that an audible alarm sounds on the SD in addition to the CRD audible alarm. It is recommended that an audible alarm or a visual alert requiring acknowledgement not be a part of the Backup Critical Display unless the CRD has failed. Every effort should be made to minimize redundant alarms and alerts at each position. The current specification provides no convenient way for a controller to activate/deactivate the alarms and alerts associated with his Backup Critical Display. However, the software specification does permit the definition of two Backup Critical Display Pages, one with alarms/alerts and one without. Upon failure of the CRD the controller could use the page without alarms until the supervisor could assign the page with alarms to his SD. This would be an infrequent occurrence.

(5) The means for having two Backup Critical Display pages, one with alarms/alerts and one without, is through the specification of two families of variables from the same basic set of variables. One family will be specified with alarms/alerts to all SD's (and TD's), the other will be specified without alarms/alerts. Two pages would then be made up with identical formats, one using the "alarm/alert" variables, one using the "no alarm/alert" variables. This technique appears possible from the specification. If it is not possible, consideration should be given to providing such capability.

(6) As a part of the Backup Critical Display description a header line and the use of the last two characters for a general alert handling procedure is described. This information was obtained from the FAA and is not contained in the specification. It should be added.

(7) RVR alarms and LLWSAS alarms on the Backup Critical Display are not discussed in any detail in the CCD specification. We assume there are no RVR alarms since there is no provision for setting the alarm values from the SD. However, when the CRD is out-of-service, there ought to be LLWSAS alarms/alerts causing an audible cue and a blinking boundary wind. The LLWSAS blinking would not stop with acknowledgement. Since the Backup Critical Display would probably be selected for display on the SD with the CRD inoperative lack of acknowledgement of the LLWSAS alert would not block previous unacknowledged alerts from being displayed in the upper right hand corner of the display.

With regard to weather pages:

(8) The general Weather Page described in Section 7.2.2, Item 12 would eliminate the need for printing out each SIGMET in hard copy. The SIGMET's would simply be one of the weather messages listed on the Weather Page.

(9) Discussions with Atlanta controllers indicate that the coded weather messages are not always found to be easily deciphered. Some automatic deciphering which would present the messages in a more readible code would be helpful.

(10) In providing the SIGMET's via the CCD, the SIGMET's will come by Service A whereas the SIGMET's now come by FDEP via the 9020 ARTCC computer. It is assumed that the CCD data obtained with a parallel Service A line with the Atlanta Flight Service Station will be as timely.

(11) The Terminal Forecasts (FT's), Winds and Temperature

Aloft Forecasts (FD's), and storm detection, radar Weather Observation Reports (SD's) are not now heavily used at Atlanta. They are received via electrowriter from the local Weather Service Forecast Office (WSFO). If a remote data entry and display terminal is furnished to the WSFO to permit entry of Atlanta surface observations, it could be used to provide these products as well. However, due to its current use pattern, listing on the SMD weather page would appear adequate. This would then be available in the cab and in the TRACON.

(12) A remote data entry and display terminal could be assigned to the ARTCC so that the Meteorological Impact Statements and center Weather Advisories could be delivered via the CCD rather than the FDEP and telephone as is now the case. However, only if it were decided that each controller should get this information on his SD (in the Cab) or TD (in the TRACON) would there be a sound reason for doing this. The current method of operation appears satisfactory.

(13) Satellite weather could be presented by the CCD if remote data entry and display terminals were installed in the satellite Cabs. In this case the FTY and MGE weather would be on a SAT-2 weather page and PDK would be on a SAT-1 weather page. These pages would be displayed on the TRACON displays of these two controllers. However, since the electrowriter outputs can now simply be posted at each interested station (i.e., wide information deployment is not needed). There is little advantage in doing this.

With regard to the Daily Log Page:

(13) It is quite possible that the Assistant Chief will choose not to enter the information both into the log via type writer and then into the CCD via keyboard. To overcome this added workload we suggest that maintenance of the Daily Record via the CCD replace the current typewriter

method. Figure 7.3-8 shows how a Daily Record might look on the SMD at about 9:40 GMT. The left column would be used to list the time. The right column would be used for Airway Facilities concurrence, probably from their own SMD. The log would continue with as many pages as required until at the end of the day the log would be printed out in hard copy for a permanent record. Such a log appears possible with the software as specified in the CCD specification.

What is not possible with the current specification is the diversion of selected lines of the log to a Daily Log Page for the SD and TD. In this suggested design, the method of diversion would be to simply begin the line to be diverted with an asterisk. In the example of Figure 7.3-8 the three lines from the Daily Log Page shown in Figure 7.3-7 are shown with asterisks. As the message was diverted the SD would alarm and a visual alert would remain until acknowledged (i.e., the line would blink). In this way the Assistant Chief could deliver critical status to each controller in the tower as it was logged. The only added work load would be the addition of an asterisk. As the problem was corrected (e.g., arrival ATIS returned to service - See Figure 7.3-9), the correction would be logged. The controller would receive an alarm due to the change in status and upon selecting the Daily Log Page would see that the problem was corrected and would acknowledge the alert. Subsequently the Assistant Chief would delete the asterisk. This would drop the line from the controllers page with no alarm. The lines on the page would move up leaving the lower lines available for added messages. If one Daily Log Page was not adequate, added pages could be defined on which the computer would automatically continue the log with a continuation message on the previous page. Continuation pages available to the computer would have previously been assigned to the SD's and TD's.

7.4 LIGHTING CONTROL PANEL DESIGN AND COMMENTS

7.4.1 Design

An example of the LCP is shown in Figure 7.4-1. Each LCP is associated with a CRD and when the three lines of runway data are assigned to the CRD, the lights on those runways come under the control of the associated LCP. In Figure 7.4-1, runways 9R, 9L, and 8 have been assigned for a west configuration operation. The large indicators on the panel are rear-projected multi-legend indicators. They will be bright characters on a dark field in the system, not black on white as shown in the figure. The three top indicators display the runways to which the column of control buttons apply. They are not themselves buttons. Each control button below the runway indicators is actuated by depressing its hinged viewing screen. The switch action is noted by the processor and appropriate action taken. The items to come under control for each runway are given in Table 7.4-1. If more than one LCP is assigned the same runway, the associated elements may be controlled from any of the control panels.

On the LCP the only items without intensity selection are the SFL's. These are turned on and off simply by successively pushing the SFL button. The line below the title, SFL, will indicate the current status. The SFL on runway 9R in the example is turned on. To control the other items the small control buttons along the bottom of the unit are used. For example, the touchdown zone lights on runway 9R are turned off in the example format. To turn them on with intensity level four, the controller would first push the "4" button and then push the "TDZ" button. The intensity level 1 line on the "TDZ" button would then change to "4" indicating the computer had received the command. It will not indicate that the TDZ lights are on. Only for the ALS's will the intensity level indicator be field acquired intensity information. Despite this difference, the intensity of all assigned equipments are controlled as is described for the 9R touchdown zone lights.

In Section 7.1, the SFL level 5 timer alarm was touched upon. When the ALS is set to level 5 a 15 minute timer is started. At the end of 14.5 minutes an alarm occurs. In this design, that alarm will cause an audible cue on the CRD's and a visual alert which is "TMR" blinking in the status area of the CRD. In addition, the intensity indicator for that runway will change from "5" to "TMR" as shown for the ALS on runway 8 in the example. If no action is taken by the controller, at the 15 minute mark, the "TMR" alert on the CRD will automatically clear and the intensity level will automatically drop to level four. Accordingly the "TMR" on the ALS button will change to "4". However, if the controller chooses, he can reset the ALS to level 5 before the 15 minutes expires. He simply pushes the ALS button. This resets the time to zero and the "TMR" indicator changes to "5" until the 14.5-minute mark is again reached.

7.4.2 Issues and Assumptions Made

(1) It should be noted that on the example CRD of Figure 7.2-1 only runways 9R and 8 have been assigned to lines. Assignment of 9L was not made in order to eliminate the string of ILS status indicators which will occur since the associated localizer, glide slope, middle marker, and outer marker will be turned off. However, with the concurrent assignment of CRD lines and LCP control columns 9L will have to be displayed on the CRD to permit control of the edge and centerline lights. The CRD will not look quite as uncluttered as depicted in Figure 7.2-1.

(2) The ALS timer reset approach taken in this design is not prescribed in the CCD specification. No approach is specified. If this design is desired it will have to be added to the specification.

7.5 TRACON DISPLAY DESIGN AND COMMENTS

7.5.1 Design

The TRACON Display (TD) will be built around a dot matrix planar gas discharge panel. Each character will be ASCII code created via a 5 by 7 dot matrix and will have a 5 by 1 cursor/underline capability. The display will be composed of 16 lines of 32 characters each. Each character will be 0.21 inches high. The first four lines of the display will have a fixed format. The last twelve lines will be able to be paged through by the operator.

The fixed format portion of the TD is shown at full scale in Figure 7.5-1. The format is identical to that of the backup critical display for the SD except that LLWSAS winds and local Atlanta weather are not included. If desired they must be called up on one of the pages as shown in Figure 7.5-2. As with the CRD, the TD has two characters and a subminiature momentary switch associated with each RVR value with which to set in an alarm value (see Figure 7.1-4). These are set and alarm similar to the settings for the CRD in the cab. The settings are displayed with incandescent characters heavily filtered to be suitable for the low ambient light level of the TRACON and to have the same green color as the planar gas discharge panel.

As with the SD, the TD can be provided with a RVR Data Page, an ILS Status Page, a Runway Lighting Page, a SIGMETs Page and a Daily Log Page. Of course, unlike the SD, the TD can only display twelve-line pages (or the first twelve lines of a 16 line page) and cannot use reverse video as a visual cue. However, only the latter constraint effects any of the previously defined pages since only 12 lines were used for each. The ILS Status Page is shown in Figure 7.5-3. As can be seen, the only impact on the page is the lack of reverse video.

The alarm/alert philosophy for the TD in the TRACON is the same as that for the CRD and SD in the cab. The alarms/alerts for the ILS and ALS will be delivered to the controllers via the critical display portion of the TD. The RVR Data Page, ILS Status Page, and Runway Lighting Status Page will not have alarms or alerts associated with them for the controllers. The Critical Display Weather Page shown in Figure 7.5-2 will have alarms/alerts. These will be identical to those on the CRD for the LLWSAS alarms and new Atlanta weather. In addition, the SIGMET Page and Daily Log Page will have alarms/alerts. A new message on each of these pages will result in an alarm (i.e., two half-second tones) and an alert (i.e., the new message will blink until acknowledged by the controller).

For the Assistant Chief in the TRACON, the alarms/alerts will also be delivered via a TD. For the ILS and ALS alarms this can be either through the critical display portion of the TD or through the specially tailored ILS Status and Runway Lighting Pages with alarms/alerts.

7.5.2 Issues and Assumptions Made

In general, the TD in the TRACON behaves like the CRD and SD in the cab. Many of the issues which were presented for those two displays in Sections 7.2.2 and 7.3.2 also apply to the TD. In addition, two other issues dealing with the TD were found.

(1) There may be a problem regarding the omission of the LLWSAS winds and Atlanta weather from the fixed format portion of the TD. This information may be as important to the final controllers as to Local Control.

(2) If, for a data page, reverse video is specified (such as for the ILS Status Page.) it would be helpful if it was simply not used when the page is called up on the TD rather than requiring two pages to be defined, one for the SD (with reverse video) and the other for the TD (without reverse video).

7.6 SUPERVISORY/MAINTENANCE DISPLAY (SMD) DESIGN AND COMMENTS

7.6.1 Functions

The SMD will be a general purpose CRT display with key board entry. Units will be placed in the cab, the TRACON, and the equipment room (for Airway Facilities personnel). The SMD will provide the CCD interface for the Airway Facilities personnel and the development contract engineers, as well as the Air Traffic personnel. Only those functions to be regularly used by Air Traffic personnel are listed here.

(1) Manual entry of ATIS as described in Section 7.2.1

(2) Manual entry of sensor values (e.g., centerfield wind) in the event of sensor failure.

(3) Assignment of runway to lines of the CRD's, and the TD's. This can be done for each line of each device or with a predefined configuration assignment as described in Section 7.2.1.

(4) The definition of families of variables including which "logical" devices (e.g., LC-1/SD for the Local Control-1 Supplementary Display) a change in variable value will cause an alarm and/or alert on.

(5) Page definition which defines the format of a page in terms of page title, page order in the string of pages, variables to be displayed, and where the variables should be displayed.

(6) Page and device assignment which specifies pages to be assigned to a logical device and the physical device which will be assigned to a logical device. For example,

    LC-1/SD, ADDRESS=SO5,TYPE=SUPPLEMENTARY,
    PAGES=BCRDXA, RVE, ILSXA, RLXA, SIGXA, LOGWA

This assigns the specific device SO5 to carry out the LC-1/SD logical device functions and assigns the following pages to the display:

    BCRDXA-Backup Critical Dispaly without alarms
    RVR-RVR Page
    ILSXA-ILS Status Page without alarms
    RLXA-Runway Lighting Page without alarms
    SIG XA-SIGMET Page without alarms
    LOGWA-Daily Log Page with alarms

This function would be used to assign the Backup Critical Display with alarms to a position in the event of CRD failure (see Section 7.2.2). It will also be used to re-configure device usage when staffing is reduced (e.g., during the night shift) or is rearranged (e.g., due to an ARTS display failure).

(7) Respond to SMD alarms/alerts. If a variable has had an alarm/alert assigned to a particular SMD (e.g., CAB Supervisor Console), an audible alarm will sound. The alarm will be two half-second tones at a frequency which will make them audibly distinguishable from the CRD, SD, and TD alarms. The alert will be displayed with an alert character in the Alert Display Field of the console header line. The supervisor will respond by entering DA [alert character] and the alert message (e.g., the new SEGMET or Atlanta weather) will be displayed.

(8) Exercise control of devices tied to the CCD computer (see Table 7.2-1) but not included on the Lighting Control Panel. These device controls include the ILS interlock controls and the ALS 9R emergency generator controls. Example command formats are:

CD, ALS 9R GENERATOR, ON   and
CD, ILS WEST, 9R

The commands are self explanatory.

7.6.2 Issues and Assumptions Made

(1) Section 1-20.3.5.5.1 of the specification associates page assignment only with the SD. However, there must be similar provisions for assigning pages to the TD. We assume this will be done with a similar statement. For example.

AR-1/TD, ADDR ESS=T07, TYPE=TRACON, PAGES=BCRDXA,... would assign logical device Final Control 1 TRACON Display to the physical device T07 with pages Backup

Critical Display without alarms, etc.

(2) Alarms/alerts on the SMD do not appear to be presented relative to pages on which the variables occur as is the case for the SD and TD. The alarm/alert variables/ messages are written out as a single line on the SMD. The formats presented for the SD pages such as the ILS Status Page do not lend themselves to this approach. For example, when the 9R localizer is turned off the variable which is displayed just says OFF. No identifier for the 9R localizer is included since that is part of the fixed format of the ILS Status Page. For this reason, we have chosen to assign a SD to the Team Supervisor and a TD to the Assistant Chief on which page related alarms can be taken. The SD is actually more conveniently located in the Cab than the SMD (at the TS desk) since the Team Supervisor is not normally at his desk. However, if it is desired that the SMD be used to present alarms to the supervisors, this can be accomplished with a new set of variable definitions which would include added text. For example, for the 9R localizer, (see Table 7.3-7 Item 7) define a new variable

[9RLOC ON MAIN]-item 1 = +28VP.C.;items 2&4≠+28VD.C.
[9RLOC ON STBY]-item 2 = +28VD.C.;items 1&4≠+28VD.C.
[9RLOC OFF] - item 4 = +28VD.C.;items 1&2≠+28VD.C.
[9RLOC STATUS ERROR] - any other combinations of items 1, 2 & 4.

This variable would then be directed to alarm/alert on the SMD's.

7.7 CCD DEVICE ASSIGNMENT

In this section the CCD devices and available pages are assigned to the control positions which are currently active in the Cab and TRACON.

7.7.1 Cab Equipment

The assignment of devices and pages is shown for the cab in Table 7.7-1. The assignment is based upon current equipment and information usage as described in Sections 3, 5, and 6. Particular reference should be made to Table 5-1, the distribution of Cab equipment. The table does not include the Daily Record Page or the general Weather Page since some CCD specification changes would be needed to properly implement these pages. If they were added to the CCD system they would be added to the SMD and the Atlanta Weather Page would be deleted. The assignments as shown in Table 7.7-1 have the following features.

(1) The CRD is shared between LC-2 and GC-3 as is now the case with the weather instrumentation. The unit would replace the current weather instruments in the corner station between the two positions. Collocated with the CRD would be a shared SD. Sharing the devices does not appear to have any disadvantage, and it will ease the installation and reduce system cost. In fact, allowing either controller to acknowledge an alarm after visually assuring that the other controller has received it may be an advantage.

(2) The CRD and SD is shared between LC-3 and GC-2 for similar reasons as given in Item 1. The units would be collocated in the corner station between the two positions.

(3) The only alarm/alert which will occur on the SD of any cab controller is on the Daily Log Page. All other needed alarms which are provided automatically by the field equipment are provided on the CRD. The SIGMET alarm/alert has not been assigned since it is our understanding that the AH-3 position is the only position which does the broadcasting. The SIGMET alarm/alert will only be given to the Team Supervisor.

(4) The only alarm/alert which will occur on the cab supervisor console (CAB SMD) will be on the Atlanta Weather Page when a new Atlanta surface observation comes in.

Even this alarm will not be present if a remote data entry and display unit is not placed in the WSFO. All the other alarms will be delivered to the Team Supervisor on a SD conveniently located at the Cab Coordinator station. In this assignment the Backup Critical Display Page has been chosen as the source for the alarms. However, the ILS Status Page and Runway Lighting Page could be set up with alarms/alerts as an option.

(5) The table does not include the currently unstaffed LC-4 station. If it is desired that this station be available for cab re-configuration an added CRD, SD, and LCP would have to be installed at this station.

7.7.2 TRACON Equipment

The assignment of devices and pages is shown for the TRACON in Table 7.7-2. As motivation for the assignment, particular reference should be made to Table 5-2, the distribution of current TRACON equipment. The assignments as shown have the following features.

(1) AH-3 and TAR-3 share a TD. With this arrangement the AH-3 can do the required paging and acknowledgements for the TAR-3, and the TD should be installed to facilitate this. The TD will normally display the critical Display Weather Page. The controller will be required to page away from this page to acknowledge Daily Log alarms/alerts and SIGMET alarms/alerts. The latter alarms are required by AH-3 for broadcast.

(2) TS-A also shares the AH-3/TAR-3 unit since this supervisor normally stands near or behind these two positions acting as coordinator for arrivals.

(3) AH-2 and TAR-2 share a TD for similar reasons as given in Item 1. No SIGMET's alarm is required.

(4) All relevant alarms/alerts are delivered to the Assistant Chief via a TD for the same reason that the Team Super-

visor in the Cab receives most of his alarms/alerts via SD. As discussed in Section 7.6.2, Item 2 the reason is that the alarm/alert approach on the SMD does not appear compatible with the formats selected for the SD and TD pages.

(5) DH-3 and DR-3 share a TD. In this way DH-3 can do the required paging and acknowledgements for the DR-3, and the TD should be installed to facilitate this. TS-D also shares the same unit since the supervisor normally stands near or behind these two positions when acting as coordinator for departures. When acting as coordinator for satellite airport operations the supervisor will share one of the satellite controllers displays.

The departure controller pages have been defined in Table 7.7-2 to be free of alarms/alerts on arrival related information. This is because the departure conditions normally would only be interested in departure related information. However, during the mid-shift, the arrival and departure functions are combined at these positions. During such times these two TD units would be assigned the TAR-3 "logical" device functions. Assignment would be made from the SMD in the TRACON (see Section 7.6.1).

(6) Each satellite controller shares his TD with his associated hand-off position. As seen in Table 7.7-2, no alarms have been assigned to the satellite controllers. The information provided by the TD is all related to the Hartsfield-Atlanta operation which the satellite controllers are not, normally interested in. However, they do give Hartsfield-Atlanta wind and altimeter information to pilots landing at satellite airports without such measurements, particularly at night. NOTAM's and outages for satellite facilities are not entered into the Daily Record. They are distributed directly to the appropriate satellite controller by the Departure-Satellite Team Supervisor. In this design it is assumed

that this procedure will continue and that the Daily Log page will only contain information on Hartsfield-Atlanta from the Daily Record. Therefore, no alarms/alerts occur on that page. If desired, a separate satellite Status Page could be defined, but since the current procedure is quite simple it has not been altered here.

(7) Only the positions which are currently active at Atlanta are included in Table 7.7-2. If it is desired that unstaffed stations be available for TRACON reconfiguration additional TD's would have to be assigned to these stations. Assuming that the radar controller would share his TD with the associated hand-off position these stations are TAR-1/AH-1, TAR-4/AH-4, DR-2/DH-2, and DR-4/DH-4.

7.7.3 Equipment Summary

The equipment assignments made in Tables 7.7-1 and 7.7-2 result in the equipments as listed in Table 7.7-3.

TABLE 7.2-1. STATUS LINES AVAILABLE

Item Number	System Identification	Type	Function Indication	Signal Characteristics
1	FUN 9R	LOC	Main	+28v D.C.
2	FUN 9R	LOC	Stby.	+28v D.C.
3	FUN 9R	LOC	Abnormal Mon.	Loss of +28v D.C.
4	FUN 9R	LOC	Off	+28v D.C.
5	FUN 9R	LOC	FFM Mismatch	+28v D.C.
6	FUN 9R	LOC	FFM Abnormal P/E	Loss of +28v D.C.
7	FUN 9R	LOC	FFM Shutdown Alert	+28v D.C.
8	FUN 9R	LOC	FFM Shutdown	+28v D.C.
9	FUN 9R	LOC	FFM Bypass	+28v D.C.
10	FUN 9R	LOC	Abnormal P/E	Loss of +28v D.C.
11	FUN 9R	ILS	Cat III Operation	+28v D.C.
12	FUN 9R	ILS	Cat II Operation	+28v D.C.
13	FUN 9R	G.S.	Main	+28v D.C.
14	FUN 9R	G.S.	Stby.	+28v D.C.
15	FUN 9R	G.S.	Abnormal Mon.	Loss of +28v D.C.
16	FUN 9R	G.S.	Abnormal P/E	Loss of +28v D.C.
17	FUN 9R	I.M.	Main	+28v D.C.
18	FUN 9R	I.M.	Stby.	+28v D.C.
19	FUN 9R	I.M.	Abnormal Mon.	Loss of +28v D.C.
20	FUN 9R	I.M.	Off	+28v D.C.
21	FUN 9R	I.M.	Abnormal P/E	Loss of +28v D.C.
22	FUN 9R	M.M.	Main	+28v D.C.
23	FUN 9R	M.M.	Stby.	+28v D.C.
24	FUN 9R	M.M.	Abnormal Mon.	Loss of +28v D.C.
25	FUN 9R	M.M.	Off	+28v D.C.
26	FUN 9R	M.M.	Abnormal P/E	+28v D.C.
27	FUN 9R	O.M.	Main	+28v D.C.
28	FUN 9R	O.M.	Stby.	+28v D.C.
29	FUN 9R	O.M.	Abnormal Mon.	Loss of +28v D.C.
30	FUN 9R	O.M.	Off	+28v D.C.
31	FUN 9R	O.M.	Abnormal P/E	Loss of +28v D.C.
32	ATLR/W8	LOC	Main	+28v D.C.
33	ATLR/W8	LOC	Stby.	+28v D.C.
34	ATLR/W8	LOC	Abnormal Mon.	Loss of +28v D.C.
35	ATLR/W8	LOC	Off	+28v D.C.
36	ATLR/W8	G.S.	Main	+28v D.C.
37	ATLR/W8	G.S.	Stby.	+28v D.C.
38	ATLR/W8	G.S.	Abnormal Mon.	Loss of +28v D.C.
38a	ATLR/W8	G.S.	Off	+28v D.C.
39	FUN 9R	G.S.	Off	+28v D.C.
40	ATLR/W8	I.M.	Main	+28v D.C.
41	ATLR/W8	I.M.	Stby.	+28v D.C.
42	ATLR/W8	I.M.	Abnormal	Loss of +28v D.C.
43	ATLR/W8	I.M.	Off	+28v D.C.
44	ATLR/W8	M.M.	Main	+28v D.C.
45	ATLR/W8	M.M.	Stby.	+28v D.C.
46	ATLR/W8	M.M.	Abnormal	Loss of +28v D.C.
47	ATLR/W8	M.M.	Off	+28v D.C.

TABLE 7.2-1. STATUS LINES AVAILABLE (CONTINUED)

Item Number	System Identification	Type	Function Indication	Signal Characteristics
48	ATLR/W8	O.M.	Main	+28v D.C.
49	ATLR/W8	O.M.	Stby.	+28v D.C.
50	ATLR/W8	O.M.	Abnormal	Loss of +28v D.C.
51	ATLR/W8	O.M.	Off	+28v D.C.
52	ATLR/W8	L.O.M.	On/Off	-50 V.D.C.(On),"O"V.D.C.(Off)
53	BRUR/W26	LOC	Main	+28v D.C.
54	BRUR/W26	LOC	Stby.	+28v D.C.
55	BRUR/W26	LOC	Off	+28v D.C.
56	BRUR/W26	G.S.	Main	+28v D.C.
57	BRUR/W26	G.S.	Stby.	+28v D.C.
58	BRUR/W26	G.S.	Off	+28v D.C.
~~59~~	~~BRUR/W26~~	~~M.M.~~	~~On/Off~~	~~+28v D.C. Delete~~
~~60~~	~~BRUR/W26~~	~~O.M.~~	~~On/Off~~	~~+28v D.C.~~ Delete
61	R/W/8 & R/W26	INTER-LOCK	(2)	
62	FSQ 27L	LOC	Main	+28v D.C.
63	FSQ 27L	LOC	Stby.	+28v D.C.
64	FSQ 27L	LOC	Off	+28v D.C.
65	FSQ 27L	G.S.	Main	+28v D.C.
66	FSQ 27L	G.S.	Stby.	+28v D.C.
67	FSQ 27L	G.S.	Off	+28v D.C.
~~68~~	~~FSQ 27L~~	~~M.M.~~	~~On/Off~~	~~+28v D.C.~~ Delete
~~69~~	~~FSQ 27L~~	~~O.M.~~	~~On/Off~~	~~+28v D.C.~~ Delete
70	9L	LOC	Main/Off	+24v D.C.
71	9L	G.S.	Main/Off	+24v D.C.
72	9L	M.M.	Main/Off	+24v D.C.
73	9L	"H"	On/Off	-50v D.C.(On),"O"vD.C.(Off)
74	Future 27R			
75	R/W 26	MALS/R	Remote On/Off	-
76	R/W 27L	MALS/R	Remote On/Off	-
77	R/W 27L,9R & 9L	INTER-LOCKS		
78	R/W 8	ALS	Step/On/Off	-
79	R/W 8	ALS	Lights Alarm	+105v D.C.
80	R/W 8	ALS	Flashers-On/Off	+105v D.C.
80a	-	VOT	On/Off	-
81	R/W 8	ALS	Flashers Alarm	+105v D.C.
81a	R/W 8	ALS	Timer Alarm	-
82	R/W 9R	ALS	Step/On/Off	-
82a	R/W 9R	ALS	Timer Alarm	-
83	R/W 9R	ALS	Lights Alarm	+105v D.C.
84	R/W 9R	ALS	Flashers On/Off	+105v D.C.
85	R/W 9R	ALS	Flashers Alarm	+105v D.C.
86	ALS 9R	Engine/Gen On/Off		+110v D.C.
87	ASR	Engine/Gen On/Off		+48v D.C.
93	VASI's, REIL's	-	-	-

TABLE 7.2-2. STATUS ALARM DEFINITION FOR THE CRITICAL DISPLAY

ALARM MESSAGE	ALARM MEANING		CONDITION*
For 9R			
CT3	9R Interlock selected and category III acceptable.		Item 11 = +28v D.C.
CT2	9r Interlock selected, category III unacceptable but category II acceptable.		Item 12 = +28v D.C.
CT1	Neither Category II nor Category III are acceptable. ILS can be used pending individual ILS element status.		Item 11 ≠ +28v D.C. and Item 12 ≠ +28v D.C.
LOC	Localizer Off	Either 9R interlock not selected or both main and standby channels have failed.	Item 4 = +28v D.C.
GS	Glide Slope Off		Item 38a= +28v D.C.
IM	Inner Marker Off		Item 43 = +28v D.C.
MM	Middle Marker Off		Item 47 = +28v D.C.
OM	Outer Marker Off		Item 51 = +28v D.C.
ALS	ALS lights out alarm		Item 79 = +105v D.C.
SFL	SFL lights out alarm		Item 81 = +105v D.C.
TMR	ALS level 5 time alarm		Item 81a= -
For 9L			
LOC	Localizer off	Either 9L interlock not selected or the main (and only) channel has failed.	Item 70 ≠ +24v D.C.
GS	Glide slope off		Item 71 ≠ +24v D.C.
MM	Middle marker off		Item 72 ≠ +24v D.C.
LOM	Outer marker off		Item 73 = 0v D.C.
No Message	ILS available for normal operation		None of the above in effect.

*Items refer to available status lines in Table 7.2-1.

TABLE 7.2-2. STATUS ALARM DEFINITIONS FOR THE CRITICAL DISPLAY (CONT'D)

ALARM MESSAGE	ALARM MEANING		CONDITION*
For 8			
LOC	Localizer off	Either 8 interlock not selected or both main and standby channels have failed.	Item 35 = +28v D.C.
GS	Glideslope off		Item 38a = +28v D.C.
IM	Inner Marker off		Item 43 = +28v D.C.
MM	Middle Marker off		Item 47 = +28v D.C.
OM	Outer Marker off		Item 51 = +28v D.C.
ALS	ALS lights out alarm		Item 79 = +105v D.C.
SFL	SFL lights out alarm		Item 81 = +105v D.C.
TMR	ALS level 5 timer alarm		Item 81a = -
No Message	ILS available for normal operation. ALS and SFL operational if turned on.		None of the above in effect.
For 27L			
LOC	Localizer off	Either 27L interlock not selected or both main and standby channels have failed	Item 64 = +28v D.C.
GS	Glideslope off		Item 67 = +28v D.C.
No Message	ILS available for normal operation		None of the above in effect.
For 26			
LOC	Localizer off	Either 26 interlock not selected or both main and standby channels have failed	Item 55 = +28v D.C.
GS	Glideslope off		Item 58 = +28v D.C.
No Message			None of the above in effect.

*Items refer to available status ines in Table 7.2-1.

TABLE 7.2-3. CURRENT RVR SENSORS

9R	touchdown (used also for 27L roll out)
9R	mid range (used also for 27L mid range)
27L	touchdown (used also for 9R roll out)
8	touchdown (used also for 26 roll out)
26	touchdown (used also for 8 roll out)

TABLE 7.2-4. RVR STATUS CODE

A	=	changing baseline
b	=	performing background check
C	=	full time self check
F	=	failure detected in self check

TABLE 7.2-5. SERVICE A ELEMENTS DISPLAYED ON THE CRITICAL DISPLAY

SERVICE A WEATHER ELEMENTS	DISPLAYED ON CD*
o Origin/station designator	X
o Message type	X
o Time of report (Zulu time)	X
o Sky condition and ceiling	X
o Visibility	X
o Weather and obstructions to vision	X
o Sea level pressure	Omit
o Temperature and dew point	X
o Wind direction, speed, character	Omit
o Altimeter setting	Omit
o Remarks	X

*If present.

TABLE 7.3-1. SUPPLEMENTARY DISPLAY PAGE OPTIONS

SUPPLEMENTARY PAGES	PURPOSE
Backup Critical Display	To serve as backup in the event of CRD failure.
RVR Data Page	To display all RVR data on a single page.
ILS Status Data Page	To provide status on ILS main and standby equipment.
ALS/MALS Data Page	To provide status and intensity settings on all runways.
Field Lighting Page	To provide status and intensity setting on all runways for centerline, edge, REIL, etc.

TABLE 7.3-2. ILS STATUS PAGE VARIABLE CODES

1. [↑] (inverted video) - 9R interlock selected.
   blank - 9R interlock not selected.
2. [↑] (inverted video) - 9L interlock selected.
   blank - 9L interlock not selected.
3. [↑] (inverted video) - 27L interlock selected.
   blank - 27L interlock not selected.

Common Interlock Item 77

4. [↑] (inverted video) - 8 interlock selected.
   blank - 8 interlock not selected.
5. [↑] (inverted video) - 26 interlock selected.
   blank - 26 interlock not selected.

Common Interlock Item 61

6. [CAT 2] - item 12 = +28v D.C.; item 11 ≠ +28v D.C.
   [CAT 3] - item 11 = +28v D.C.; item 12 ≠ +28v D.C.
   [CAT 1] - items 11 & 12 ≠ +28v D.C.
   [EROR] - items 11 & 12 = +28v D.C.
7. [MAIN] - item 1 = +28v D.C.; items 2 & 4 ≠ +28v D.C.
   [STBY] - item 2 = +28v D.C.; items 1 & 4 ≠ +28v D.C.
   [OFF] (inverted video) - item 4 = +28v D.C.; items 1&2 ≠ +28v D.C.
   [EROR] - any other combinations of items 1, 2 & 4.
8. [MON] - item 3 ≠ +28v D.C.
   blank - item 3 = +28v D.C.
9. [PE] - item 10 ≠ +28v D.C.
   blank - item 10 = +28v D.C.
10. [MAIN] - item 13 = +28v D.C.; items 14&39 ≠ +28v D.C.
    [STBY] - item 14 = +28v D.C.; items 13&39 ≠ +28v D.C.
    [OFF] (inverted video) - item 39 = +28v D.C.; items 13&14 ≠ +28v D.C.
    [EROR] - any other combinations of items 13, 14, & 39.
11. [MON] - item 15 ≠ +28v D.C.
    blank - item 15 = +28v D.C.
12. [PE] - item 16 ≠ +28v D.C.
    blank - item 16 = +28v D.C.
13. [MAIN] - item 17 = +28v D.C.; items 18&20 ≠ +28v D.C.
    [STBY] - item 18 = +28v D.C.; items 17&20 ≠ +28v D.C.
    [OFF] (inverted video) - item 20 = +28v D.C.; items 17&18 ≠ +28v D.C.
    [EROR] - any other combination of items 17, 18 & 20.
14. [MON] - item 19 ≠ +28v D.C.
    blank - item 19 = +28v D.C.
15. [PE] - item 21 ≠ +28v D.C.
    blank - item 21 = +28v D.C.

TABLE 7.3-2. ILS STATUS PAGE VARIABLE CODES (CONTINUED)

16. [MAIN] - item 22 = +28v D.C.; items 23&25 $\neq$ +28v D.C.
    [STBY] - item 23 = +28v D.C.; items 22&25 $\neq$ +28v D.C.
    [OFF] (inverted video)-item 25 = +28v D.C.; items 22&23$\neq$+28v D.C.
    [EROR] - any other combination of items 22, 23, & 25.
17. [MON] - item 24 $\neq$ +28v D.C.
    blank - item 24 = +28v D.C.
18. [PE] - item 26 $\neq$ +28v D.C.
    blank - item 26 = +28v D.C.
19. [MAIN] - item 27 = +28v D.C.; items 28&20 $\neq$ +28v D.C.
    [STBY] - item 28 = +28v D.C.; items 27&30 $\neq$ +28v D.C.
    [OFF] (inverted video)-item 30 = +28v D.C.; items 27&28 $\neq$+28v D.C.
    [EROR] - any other combination of items 27, 28 & 30.
20. [MON] - item 29 $\neq$ +28v D.C.
    blank - item 29 = +28v D.C.
21. [PE] - item 31 $\neq$ +28v D.C.
    blank - item 31 = +28v D.C.
22. [MAIN] - item 32 = +28v D.C.; items 33&35 $\neq$ +28v D.C.
    [STBY] - item 33 = +28v D.C.; items 32&35 $\neq$ +28v D.C.
    [OFF] (inverted video)-item 35 = +28v D.C.; items 32&33$\neq$+28v D.C.
    [EROR] - any other combinations of items 32, 33 & 35.
23. [ABN] - item 34 $\neq$ +28v D.C.
    blank - item 34 = +28v D.C.
24. [MAIN] - item 36 = +28v D.C.; items 37&38a $\neq$ +28v D.C.
    [STBY] - item 37 = +28v D.C.; items 36&38a $\neq$ +28v D.C.
    [OFF] (inverted video)-item 38a =+28v D.C.; items 36&37$\neq$+28v D.C.
    [EROR] - any other combinations of items 36, 37 & 38a.
25. [ABN] - item 38 $\neq$ +28v D.C.
    blank - item 38 = +28v D.C.
26. [MAIN] - item 40 = +28v D.C.; items 41&43 $\neq$ +28v D.C.
    [STBY] - item 41 = +28v D.C.; items 40&43 $\neq$ +28v D.C.
    [OFF] (inverted video)-item 43 = +28v D.C.; items 40&41$\neq$+28v D.C.
    [EROR] - any other combinations of items 40, 41 & 43.
27. [ABN] - item 42 $\neq$ +28v D.C.
    blank - item 42 = +28v D.C.
28. [MAIN] - item 44 = +28v D.C.; items 45&47 $\neq$ +28v D.C.
    [STBY] - item 45 = +28v D.C.; items 44&47 $\neq$ +28v D.C.
    [OFF] (inverted video)-item 47 = +28v D.C.; items 44&45$\neq$+28v D.C.
    [EROR] - any other combinations of items 44, 45 & 47.
29. [ABN] - item 46 $\neq$ +28v D.C.
    blank - item 46 = +28v D.C.

30. [MAIN] - item 48 = +28v D.C.; items 49&51 ≠ +28v D.C.
    [STBY] - item 49 = +28v D.C.; items 48&51 ≠ +28v D.C.
    [OFF] (inverted video)-item 51 = +28v D.C.; items 48&49≠+28v D.C.
    [EROR] - any other combinations of items 48, 49 & 51.

31. [ABN] - item 50 ≠ +28v D.C.
    blank - item 50 = +28v D.C.

32. [MAIN] - item 52 = -50v D.C.
    [OFF] (inverted video) - item 52 = 0v D.C.
    [EROR] - item 52 ≠ -50v D.C. or 0v D.C.

33. [MAIN] - item 53 = +28v D.C.; items 54&55 ≠ +28v D.C.
    [STBY] - item 54 = +28v D.C.; items 53&55 ≠ +28v D.C.
    [OFF] (inverted video) - item 55 = +28v D.C.; items 53&54≠+28v D.C.
    [EROR] - any other combinations of items 53, 54 &55.

34. [MAIN] - item 56 = +28v D.C.; items 57&58 ≠ +28v D.C.
    [STBY] - item 57 = +28v D.C.; items 56&58 ≠ +28v D.C.
    [OFF] (inverted video)-item 58 = +28v D.C.; items 56&57≠+28v D.C.
    [EROR] - any other combinations of items 56, 57 & 58.

35. [MAIN] - item 62 = +28v D.C.; items 63&64 ≠ +28v D.C.
    [STBY] - item 63 = +28v D.C.; items 62&64 ≠ +28v D.C.
    [OFF] (inverted video) - item 64 = +28v D.C.;items 62&63≠+28v D.C.
    [EROR] - any other combinations of tiems 62, 63 & 64.

36. [MAIN] - item 65 = +28v D.C.; items 66&67 ≠ +28v D.C.
    [STBY] - item 66 = +28v D.C.; items 65&67 ≠ +28v D.C.
    [OFF] (inverted video)-item 67 = +28v D.C.; items 65&66≠+28v D.C.
    [EROR] - any other combinations of items 65, 66 & 67

37. [MAIN] - item 70 = +24v D.C.
    [OFF] (inverted video) - item 70 ≠ +24v D.C.

38. [MAIN] - item 71 = +24v D.C.
    [OFF] (inverted video) - item 71 ≠ +24v D.C.

39. [MAIN] - item 72 = +24v D.C.
    [OFF] (inverted video) - item 72 ≠ +24v D.C.

40. [MAIN] - item 73 = -50v D.C.
    [OFF] (inverted video) - item 73 = 0v D.C.
    [EROR] - item 73 ≠ -50v D.C. or 0v D.C.

41. [MAIN] - item 80a = "ON"
    [OFF] - item 80a = "OFF"

TABLE 7.3-3. RUNWAY LIGHTING PAGE VARIABLE CODES

1. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 82.
2. [ALM] - item 83 = +105v D.C.
   blank - item 83 ≠ +105v D.C.
3. [ON] - item 84 = +105v D.C.
   [OFF] (inverted video) - item 84 ≠ +105v D.C.
4. [ALM] - item 85 = +105v D.C.
   blank - item 85 ≠ +105v D.C.
5. Step [1], [2], [3], [4], [5], or [OFF] (inverted video) based upon item 92.
6. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 94.
7. Step [1], [2], [3], [4], [5], or [OFF] (inverted video) based upon item 92.
8. [ON] - item 86 = +110v D.C.
   [OFF] (inverted video) - item 86 ≠ +110v D.C.
9. Step [1], [2], [3], [4], [5], or [OFF] (inverted video) based upon item 78.
10. [ALM] - item 79 = +105v D.C.
    blank - item 79 ≠ +105v D.C.
11. [ON] - item 80 = +105v D.C.
    [OFF] (inverted video) - item 80 ≠ +105v D.C.
12. [ALM] - item 81 = +105v D.C.
    [OFF] (inverted video) - item 81 ≠ +105v D.C.
13. Step [1], [2], [3], [4], [5], or [OFF] (inverted video) based upon item 92.
14. Step [1], [2], [3], [4], [5], or [OFF](inverted video) based upon item 94.
15. Step [1], [2], [3], [4], [5], or [OFF](inverted video) based upon item 92.
16. Step [LO], [MD], [HI] or [OFF] (inverted video) based upon item 76.
17. Step [1], [2], [3], [4], [5], or [OFF] (inverted video based upon item 92.
18. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 94.
19. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 92.
20. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 94.

21. Step [LO], [MD], [HI] or [OFF] (inverted video) based upon item 93.
22. Step [LO], [MD], [HI], or [OFF] (inverted video based upon item 75.
23. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 92.
24. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 94.
25. Step [1], [2], [3], [4], [5] or [OFF] (inverted video) based upon item 92.
26. Step [1], [2], [3], [4], [5], or [OFF] (inverted video) based upon item 94.

TABLE 7.4-1. CONTROL VALUE ASSIGNMENT FOR LIGHTING CONTROL PANEL

		RUNWAYS					
ELEMENT	SELECTABLE CONTROL VALUES	8	26	9R	27L	9L	27R
ALS	Off, intensities 1,2,3,4,5	X		X			
SFL	Off, On	X		X			
EDGE	Off, intensities 1,2,3,4,5	X	X	X	X	X	X
CENTERLINE	Off, intensities 1,2,3,4,5	X	X	X	X	X	X
Touchdown Zone	Off, intensities 1,2,3,4,5	X		X			
MALSR	Off, intensities low, medium, high		x		x		
VASI	Off, intensities low, medium, high						X

TABLE 7.7-1. DEVICE ASSIGNMENT IN THE CAB

CAB INTERFACES	CAB POSITIONS: TS CC POSITION	TS DESK	LC-1	LC-2	LC-3	GC-1	GC-2	GC-3	CD
Critical Display			A	A	A	A (1)			
Supplementary Display	A		A	A	A	A (1)			A
Backup Critical Display	A		X (3)	X (3)	X (3)	X (3)			X (3)
RVR Data Page	X		X	X	X	X			X
ILS Status Page	X		X	X	X	X			X
Runway Lighting Page	X		X	X	X	X			X
Sigmets Page	A		X	X	X	X			X
Daily Log Page	X		A	A	A	A			A
Supervisory/Maintenance Display									
Backup Critical Display		A							
RVR Data Page		X							
ILS Status Page		X							
Runway Lighting Page		X							
Segmets Page		X							
Atlanta Weather Page		A (2)							
Daily Log Page		X							
Lighting Control Panel			X		X				

X Installed at the Cab position with no alarms or alerts
A Installed at the Cab position with audible alarms and visual alerts
○ Device is shared by two positions.

(1) Desired but not crucial. GC-1 is staffed about once/week and currently shares the weather instruments with LC-3 and GC-2.

(2) Only required if Atlanta weather comes from the WSFO via remote data entry and display unit.

(3) Except in the event of CRD failure a Backup Critical Display Page with alarms/alerts will be assigned by the Team Supervisor.

TABLE 7.7-2. DEVICE ASSIGNMENT IN THE TRACON

TRACON INTERFACES	AC	TS-A	TAR-2	TAR-3	AR-1	AR-2	AH-3	AH-2	TS-D	MON1/2	DR-1	DR-3	DH-3	SAT-1	SAT-2	SAT-3	SATH-1	SATH-2	SATH-3
									TRACON POSITIONS										
TRACON Display	A		A	A	A	A				A	A	A		X	X	X			
Atlanta Runways Assigned	A		A	A	A	A				A									
Atlanta Runway Not Assigned											X	X		X	X	X			
Critical Display Weather Page	A		A	A	A	A				A	X	X		X	X	X			
RVR Data Page	X		X	X	X	X				X	X	X		X	X	X			
ILS Status Page	X		X	X	X	X				X	X	X		X	X	X			
Runway Lighting Page	X		X	X	X	X				X	X	X		X	X	X			
Sigmet's Page	A		X	A	X	X				X	X	X		X	X	X			
Daily Log Page	X		A	A	A	A				A	A	A		X	X	X			
Supervisory/Maintenance Display	X																		
Backup Critical Display	X																		
RVR Data Page	X																		
ILS Status Page	X																		
Runway Lighting Page	X																		
Sigmets Page	X																		
Daily Log Page	X																		

X Installed at the TRACON position with no alarms/alerts.
A Installed at the TRACON position with alarms/alerts.
◯ Device is shared by two positions.

TABLE 7.7-3. NUMBERS OF DEVICES REQUIRED

	STAFFED POSITIONS	UNSTAFFED STATIONS
Critical Displays	4	1
Supplementary Displays	6	1
Lighting Control Panels	2	1
TRACON Displays	11	4
Supervisory/Maintenance Units	2	

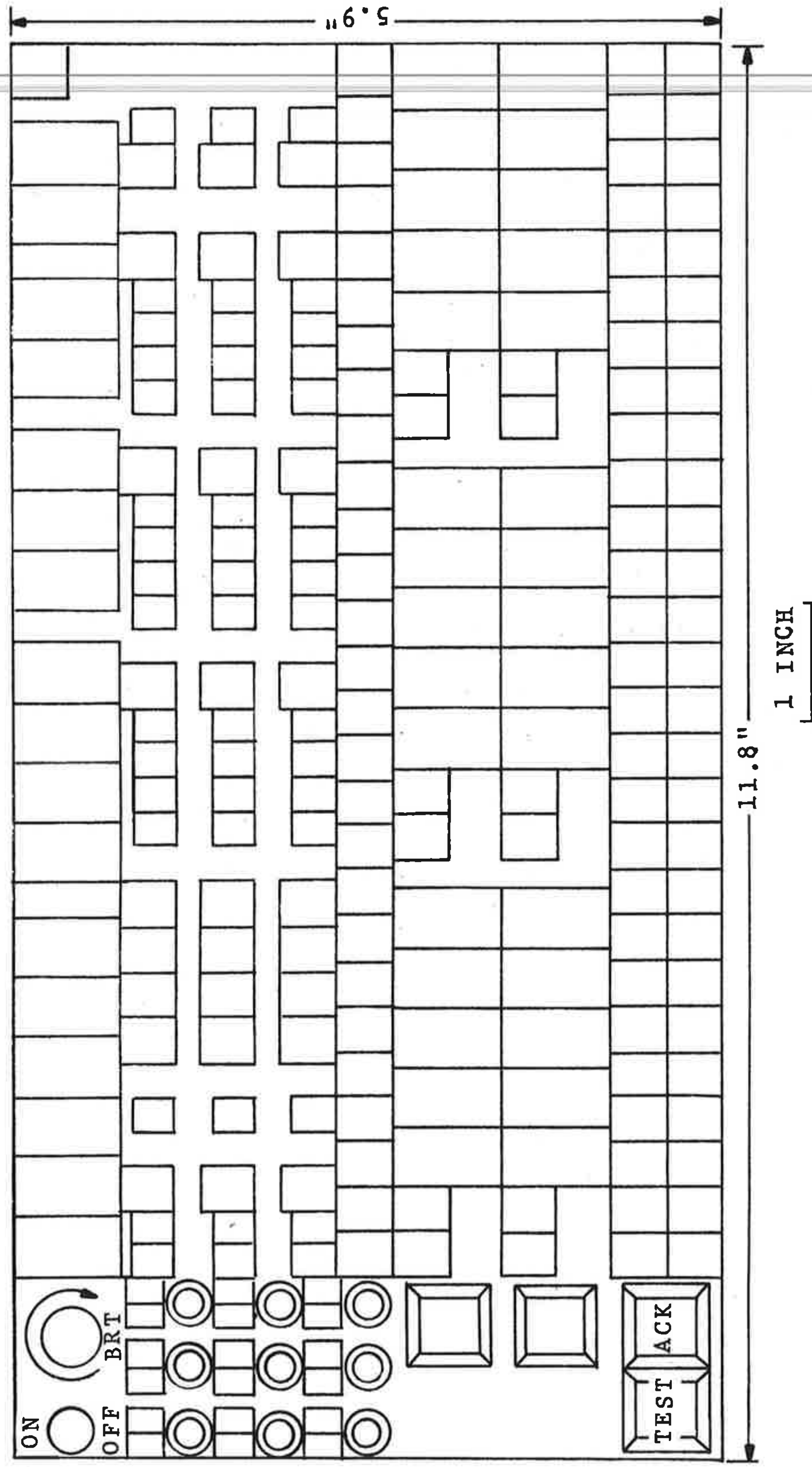


FIGURE 7.1-1. CRITICAL DISPLAY (CRD) SCALE DRAWING

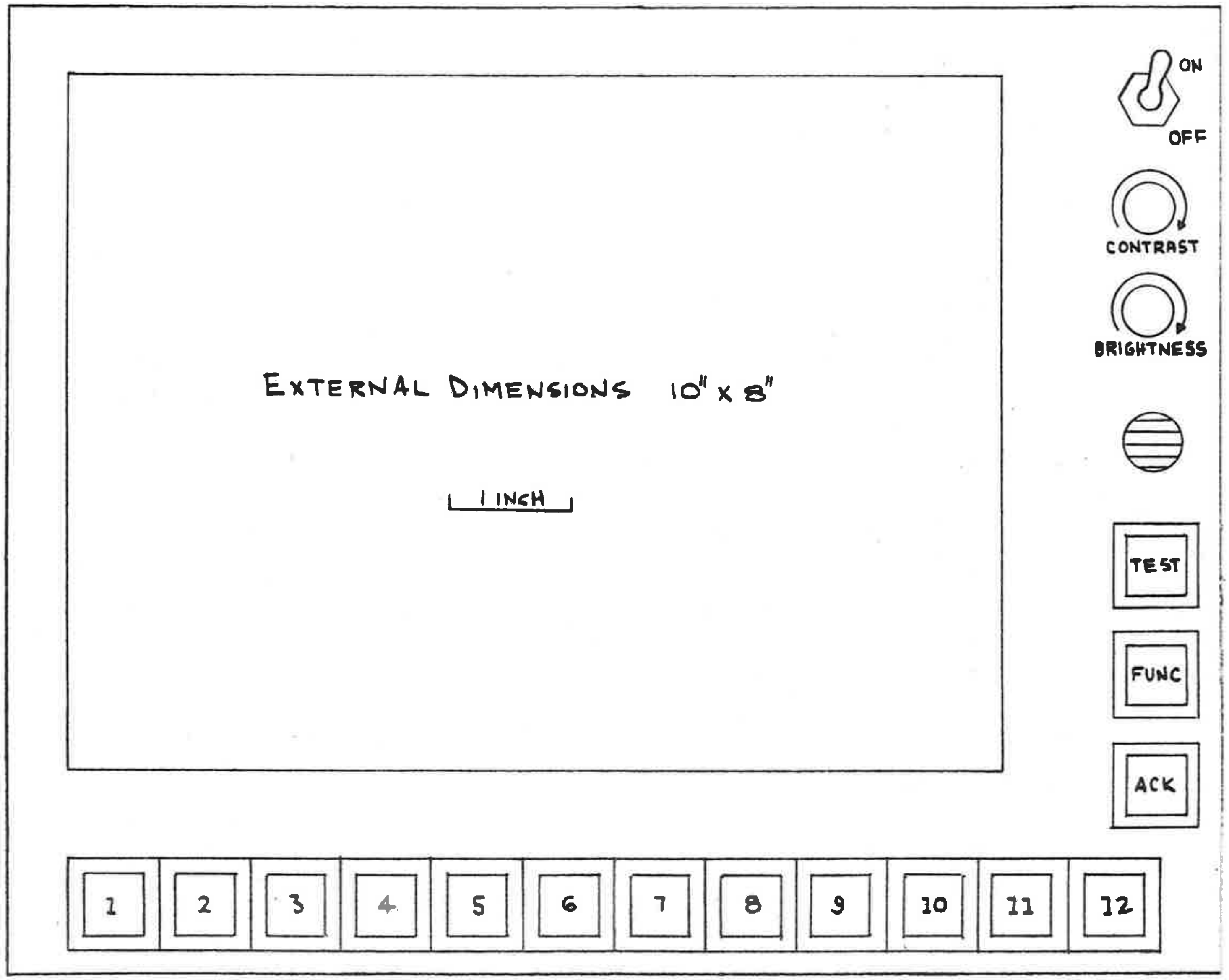


FIGURE 7.1-2. SUPPLEMENTARY DISPLAY (SD) SCALE DRAWING

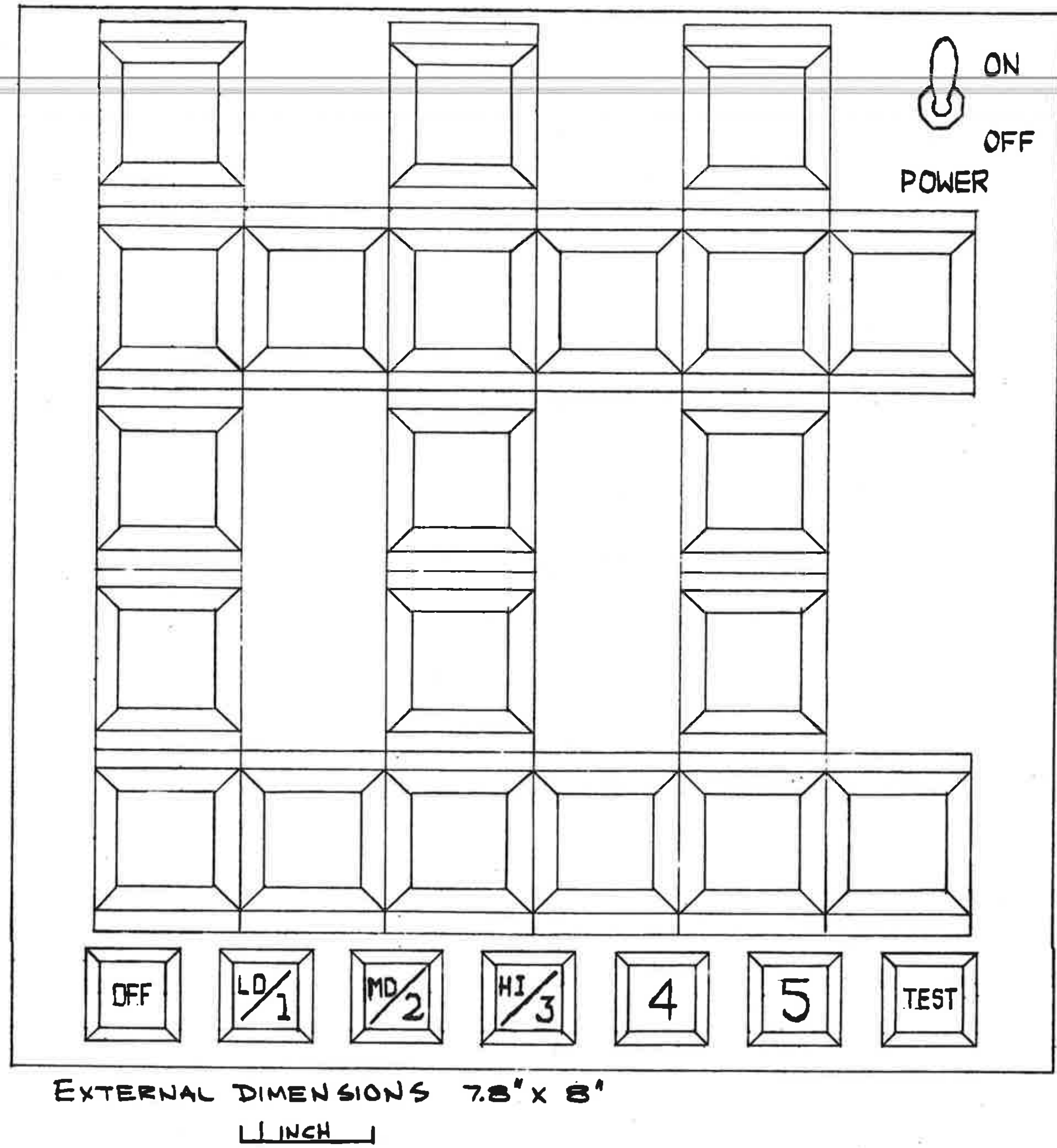


FIGURE 7.1-3. LIGHTING CONTROL PANEL (LCP) SCALE DRAWING

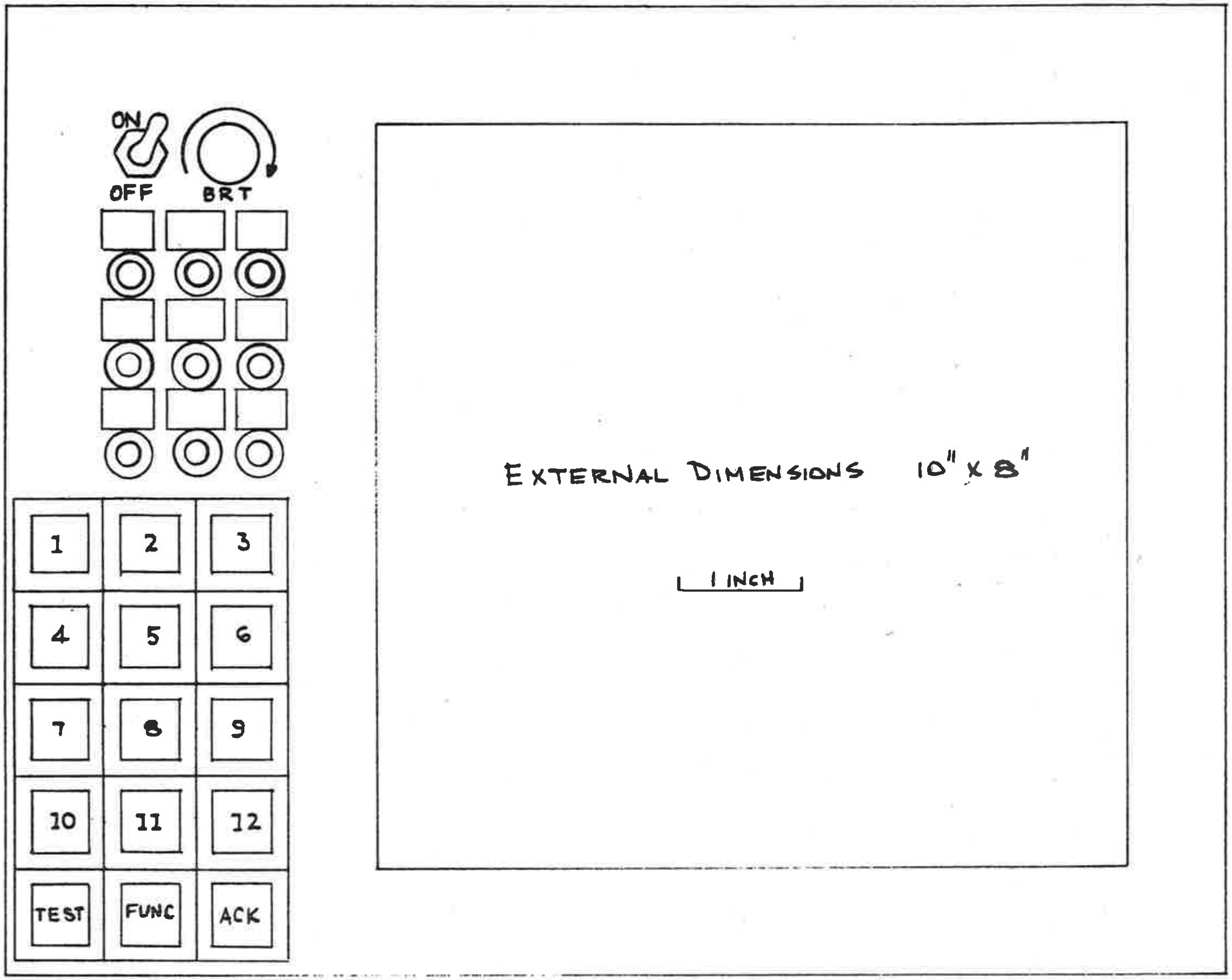


FIGURE 7.1-4. TRACON DISPLAY (TD) SCALE DRAWING

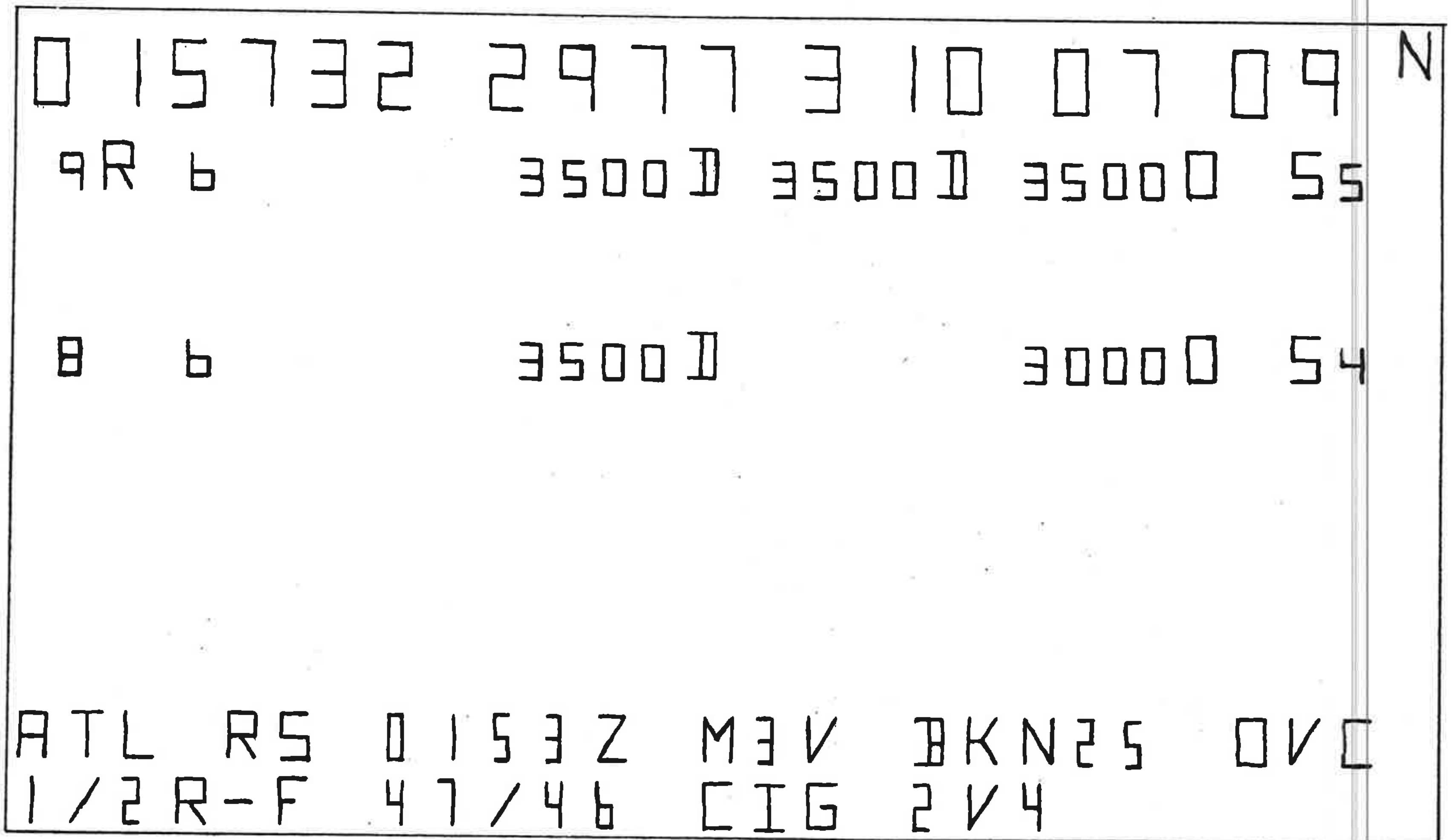


FIGURE 7.2-1. CRITICAL DISPLAY FORMAT

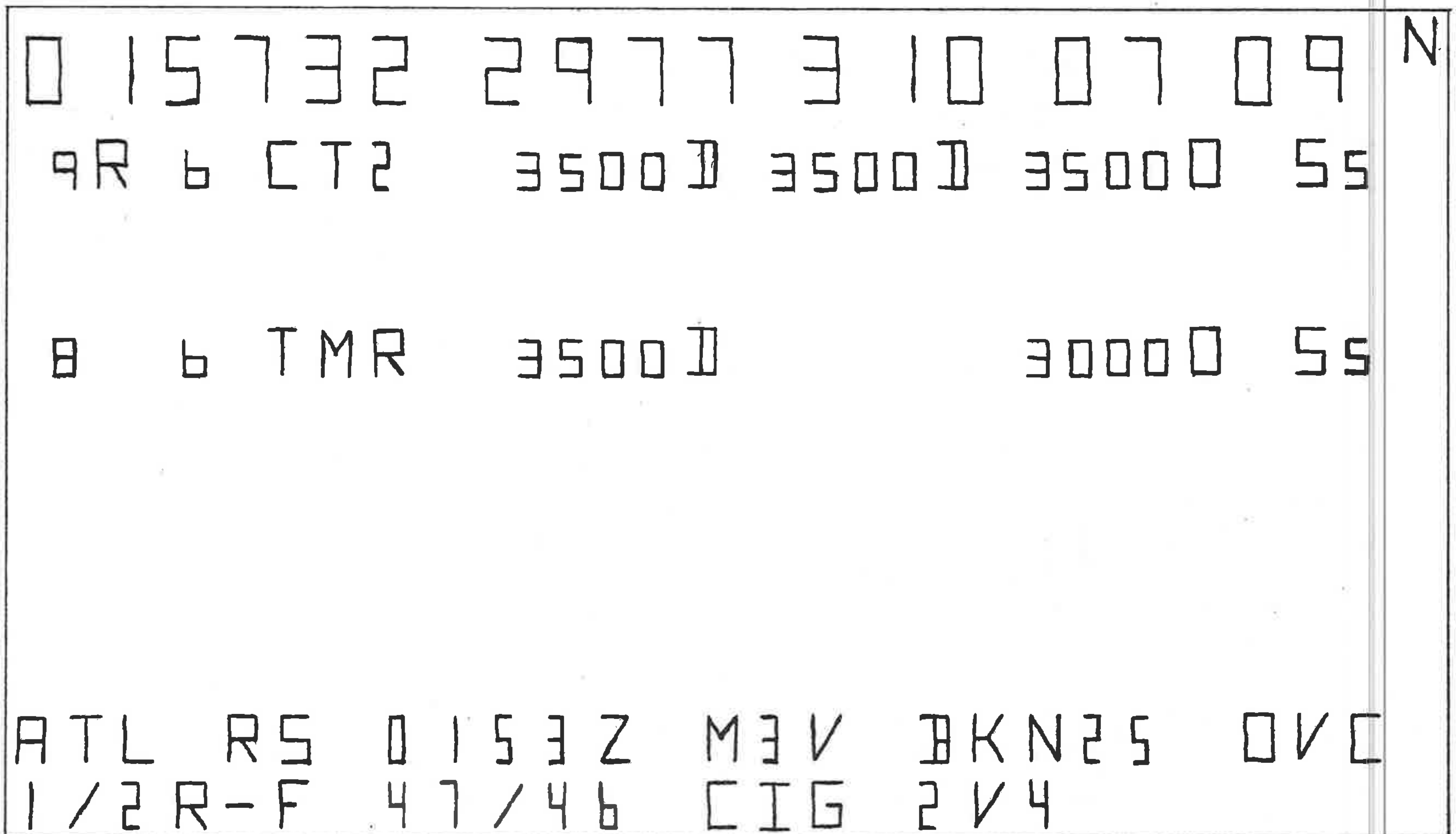


FIGURE 7.2-2. CRITICAL DISPLAY STATUS ALARM

```
0 15732 2977 3 10 07 09  N
 9R 6 CT2 ▫ 3500D 3500D 3500D  55


 8  6 TMR  3500D           3000D  55
▫ALSSFL





ATL  RS  0153Z  M3V  BKN25  OVC
1/2R-F  47/46  CIG  2V4
```

FIGURE 7.2-3. CRITICAL DISPLAY STATUS ALARM (CONT'D)

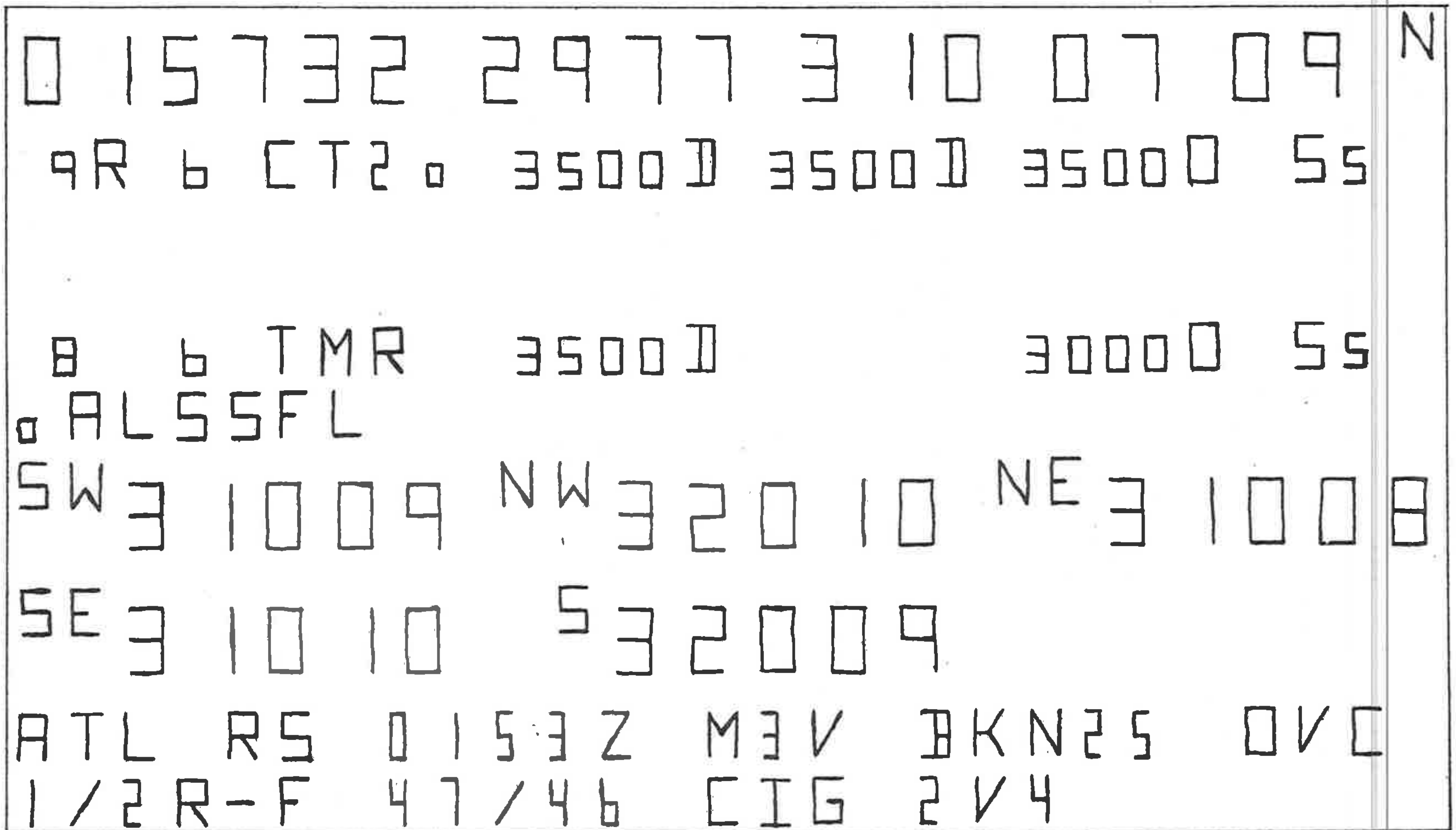


FIGURE 7.2-4. CRITICAL DISPLAY WITH LLWSAS WINDS

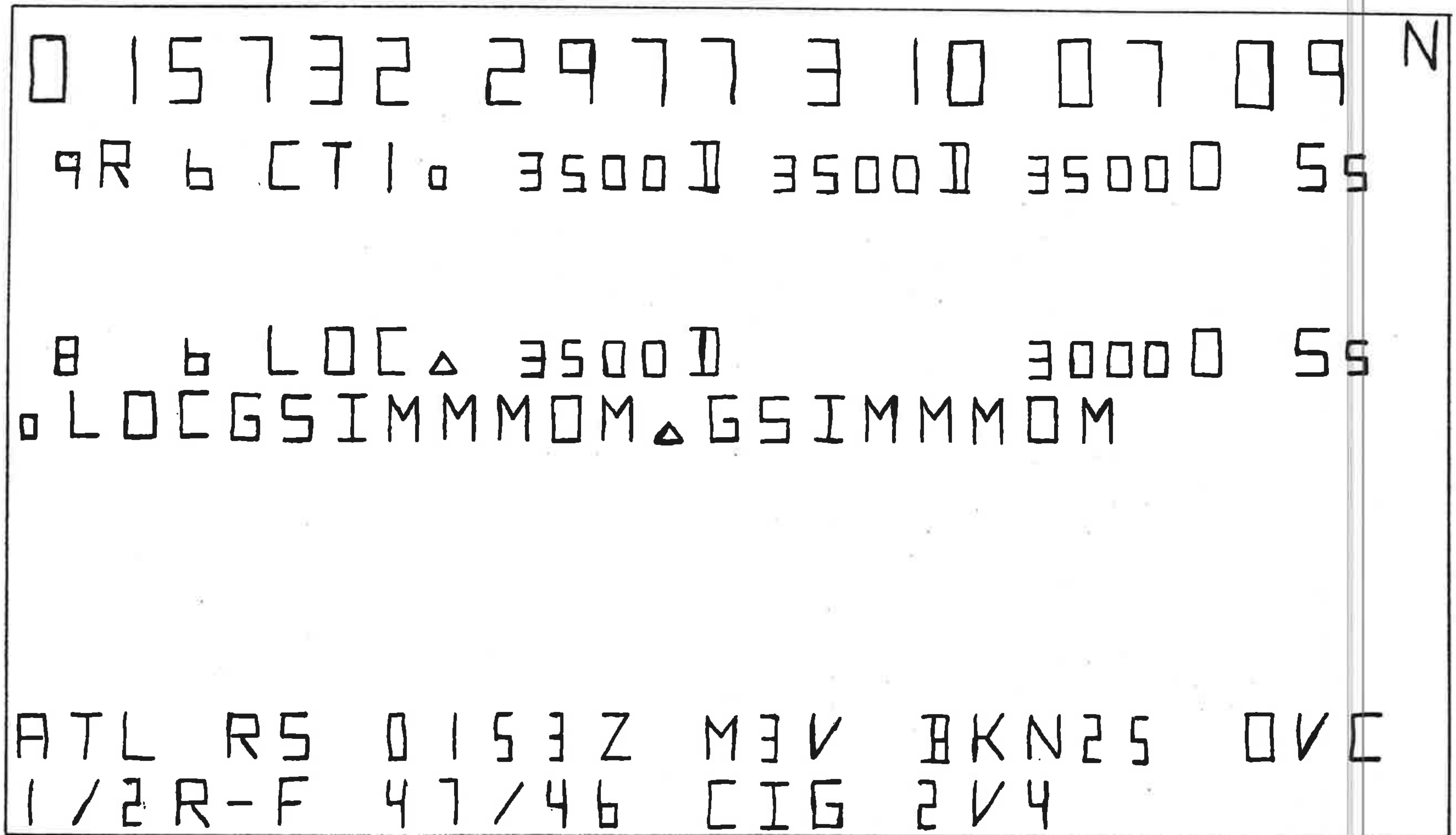


FIGURE 7.2-5. ILS STATUS ALARMS ON THE CRD DURING A CONFIGURATION CHANGE

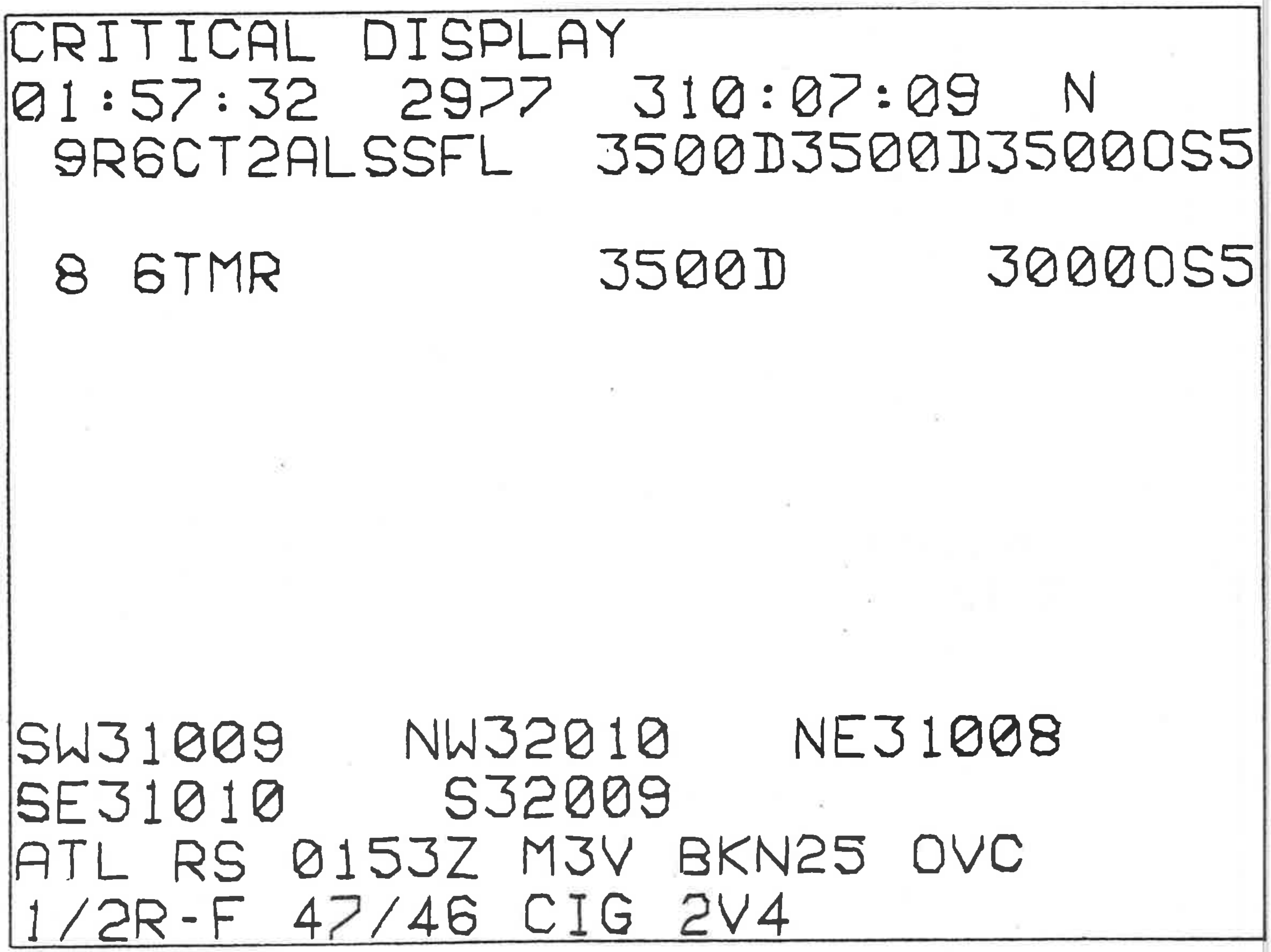


FIGURE 7.3-1. BACKUP CRITICAL DISPLAY ON THE SUPPLEMENTARY DISPLAY

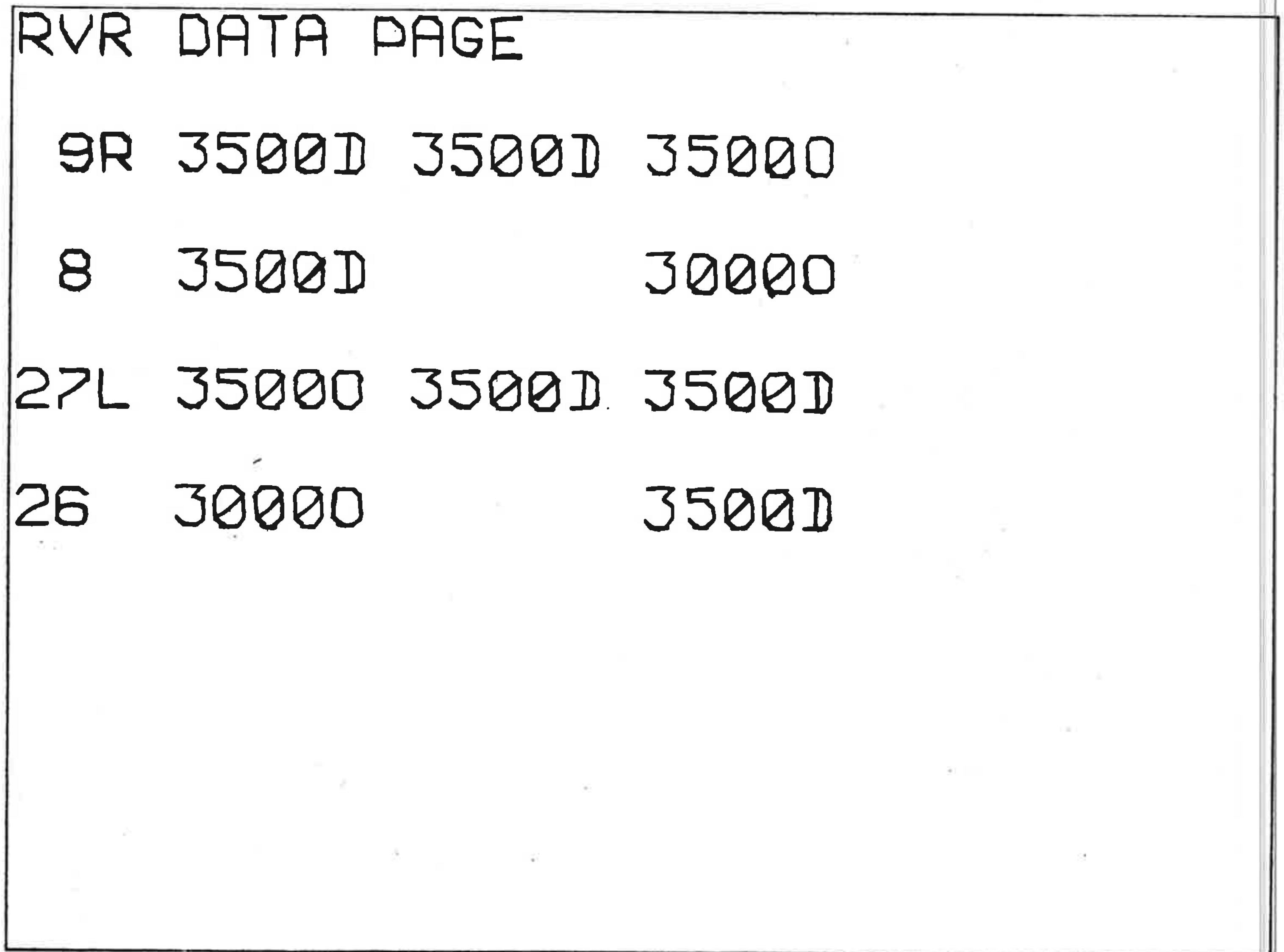


FIGURE 7.3-2. RVR DATA PAGE ON THE SUPPLEMENTARY DISPLAY

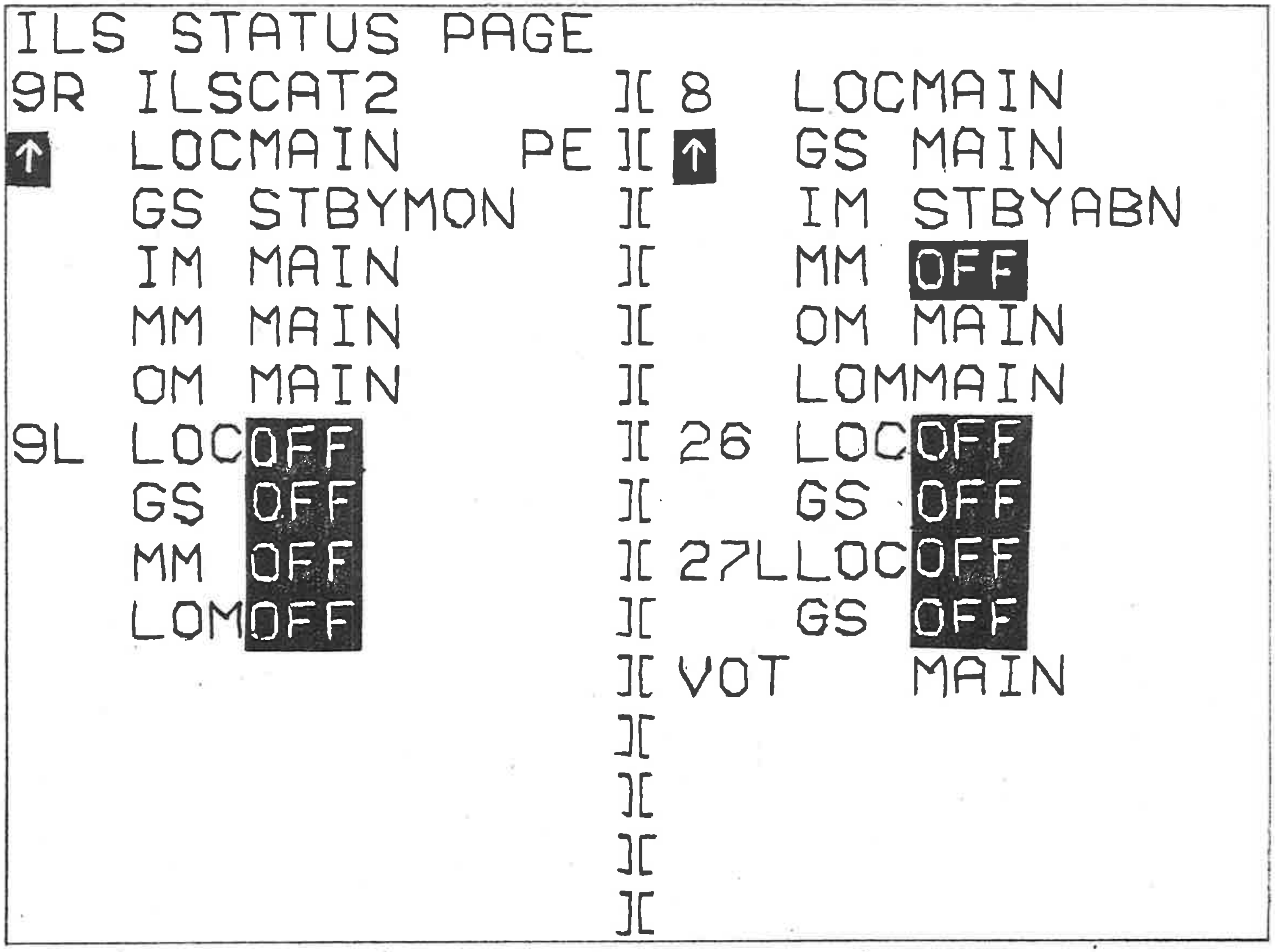


FIGURE 7.3-3. ILS STATUS PAGE ON THE SUPPLEMENTARY DISPLAY

```
ILS STATUS PAGE
9R  ILS(  6  )             ][ 8    LOC( 22  ][ 23 ]
[1] LOC(  7  ][ 8  ][ 9 ]  ][ [4]  GS  ( 24  ][ 25 ]
    GS  ( 10 ][ 11 ][12 ]  ][      IM  ( 26  ][ 27 ]
    IM  ( 13 ][ 14 ][15 ]  ][      MM  ( 28  ][ 29 ]
    MM  ( 16 ][ 17 ][18 ]  ][      OM  ( 30  ][ 31 ]
    OM  ( 19 ][ 20 ][21 ]  ][      LOM( 32  ]
9L  LOC( 37  ]             ][ 26   LOC( 33  ]
[2] GS  ( 38 ]             ][      GS  ( 34  ]
    MM  ( 39 ]             ][ 27LLOC( 35  ]
    LOM( 40  ]             ][      GS  ( 36  ]
                           ][ VOT      ( 41  ]
                           ][
                           ][
                           ][
                           ][
```

FIGURE 7.3-4. ILS STATUS PAGE VARIABLE DEFINITIONS

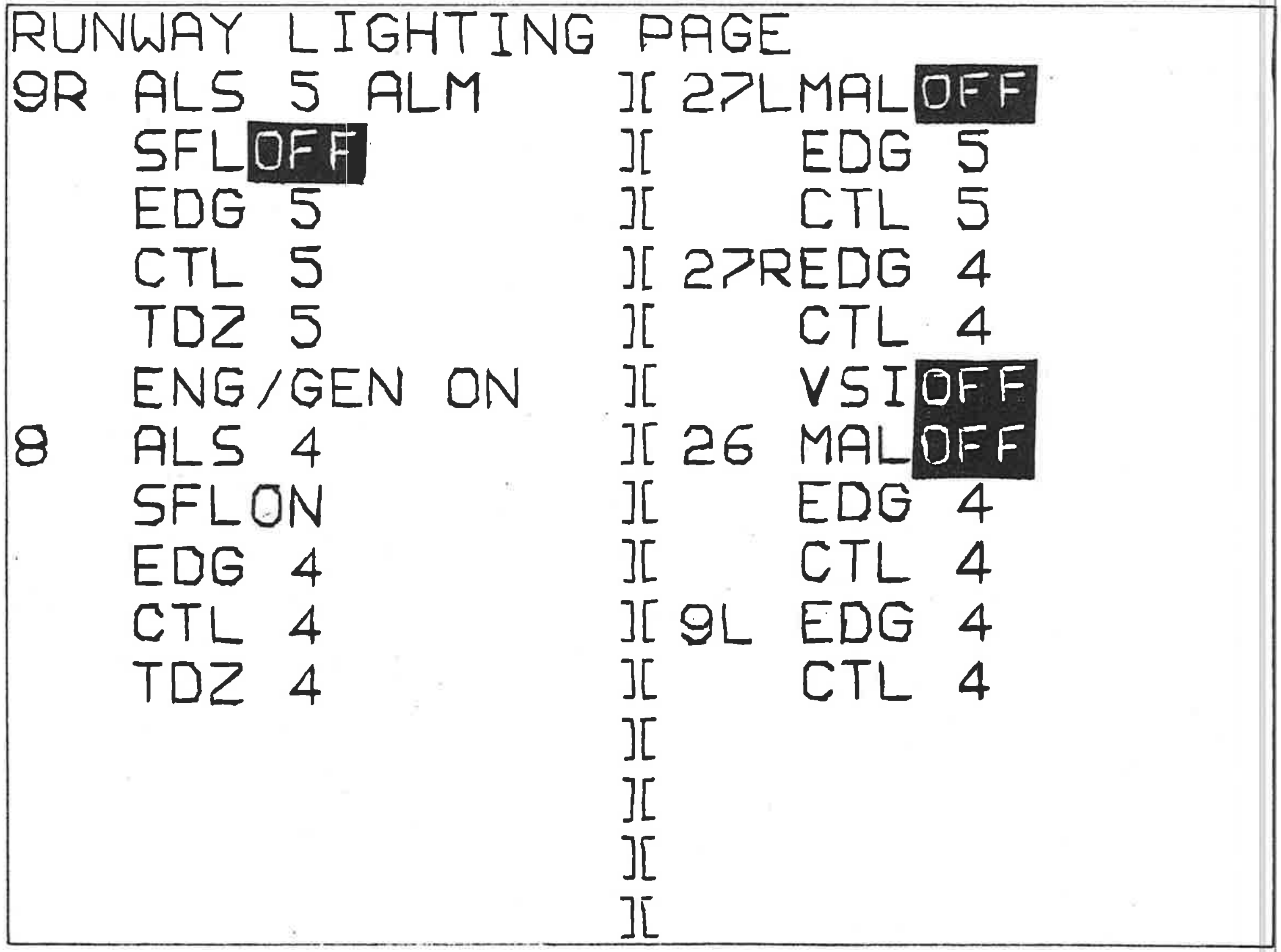


FIGURE 7.3-5. RUNWAY LIGHTING PAGE ON THE SUPPLEMENTARY DISPLAY

```
RUNWAY LIGHTING PAGE
9R  ALS[ 1 ][ 2 ]   ][ 27LMAL[ 16 ]
    SFL[ 3 ][ 4 ]   ][     EDG[ 17 ]
    EDG[ 5 ]        ][     CTL[ 18 ]
    CTL[ 6 ]        ][ 27REDG[ 19 ]
    TDZ[ 7 ]        ][     CTL[ 20 ]
    ENG/GEN[ 8 ]    ][     VSI[ 21 ]
8   ALS[ 9 ][ 10 ]  ][ 26  MAL[ 22 ]
    SFL[ 11 ][ 12 ] ][     EDG[ 23 ]
    EDG[ 13 ]       ][     CTL[ 24 ]
    CTL[ 14 ]       ][ 9L  EDG[ 25 ]
    TDZ[ 15 ]       ][     CTL[ 26 ]
                    ][
                    ][
                    ][
                    ][
```

FIGURE 7.3-6. RUNWAY LIGHTING PAGE VARIABLE DEFINITIONS

```
DAILY LOG PAGE
TXWY R CLOSED SOUTH RWY 26/8 UN-
 TIL 1230
ARRIVAL ATIS OTS MAINT.
RWY 8/26 CLOSED FOR CONTRACT WO-
 RK.
```

FIGURE 7.3-7. DAILY LOG PAGE ON THE SUPPLEMENTARY DISPLAY

TIME	REMARKS-DAILY1	INITIAL
0401	HA ON.WEST OPERATION.CARRYOVER:	
	*TXWY R CLOSED SOUTH RWY 26/8 UNTIL 1230.	
0411	WATCH CHECKLIST COMPLETE.	
0414	EAST OPERATION.	
0510	*ARRIVAL ATIS OTS MAINT.	0510JHN
0900	*RWY 8/26 CLOSED FOR CONTRACT WORK.	
	NO PRIOR NOTICE GIVEN OF PENDING CLOSURE.	
0940	WEST OPERATION.	

FIGURE 7.3-8. DAILY RECORD AT 0940 GMT ON THE SUPERVISOR/MAINTENANCE DISPLAY

TIME	REMARKS-DAILY1	INITIAL
0401	HA ON.WEST OPERATION.CARRYOVER:	
	TXWY R CLOSED SOUTH RWY 26/8 UNTIL 1230.	
0411	WATCH CHECKLIST COMPLETE.	
0414	EAST OPERATION.	
0510	ARRIVAL ATIS OTS MAINT. RTS 0950	0510JHN
0900	RWY 8/26 CLOSED FOR CONTRACT WORK.	0950JHN
	NO PRIOR NOTICE GIVEN OF PENDING CLOSURE.	
0940	WEST OPERATION.	
1125	TXWY R OPEN.	
1145	KK ON.WEST OPERATION.WATCH CHCKLST COMP 1220.	
	*9R APPR LTS ON BUT NOT CONTROLLED FROM TWR.AFS WORKING ON.	1230 LF
1232	8/26 OPEN.	
1328	DL125 B727 LANDED SAFELY RWY 26 WITH HYDRAULIC PROBLEM.EQUIP ON	
	STBY.CTY SUPERVISOR-POLICE-CONTROL CENTRAL NOTIFIED.ACDO NOTIFIED.	
1550	EAST OPERATION.	
1655	DEPARTURE DELAYS EXCEED 30 MIN.CFCF NOTIFIED.CENTER RESTRICTIONS	
	ACCOUNT WEATHER.	
1705	*8-26 CLOSED BY CITY TO FILL DITCH NEAR TXWY H.NOTAM.	
	CONTINUED ON PAGE DAILY2	

FIGURE 7.3-9. DAILY RECORD AT 2000 GMT ON THE SUPERVISOR/MAINTENANCE DISPLAY

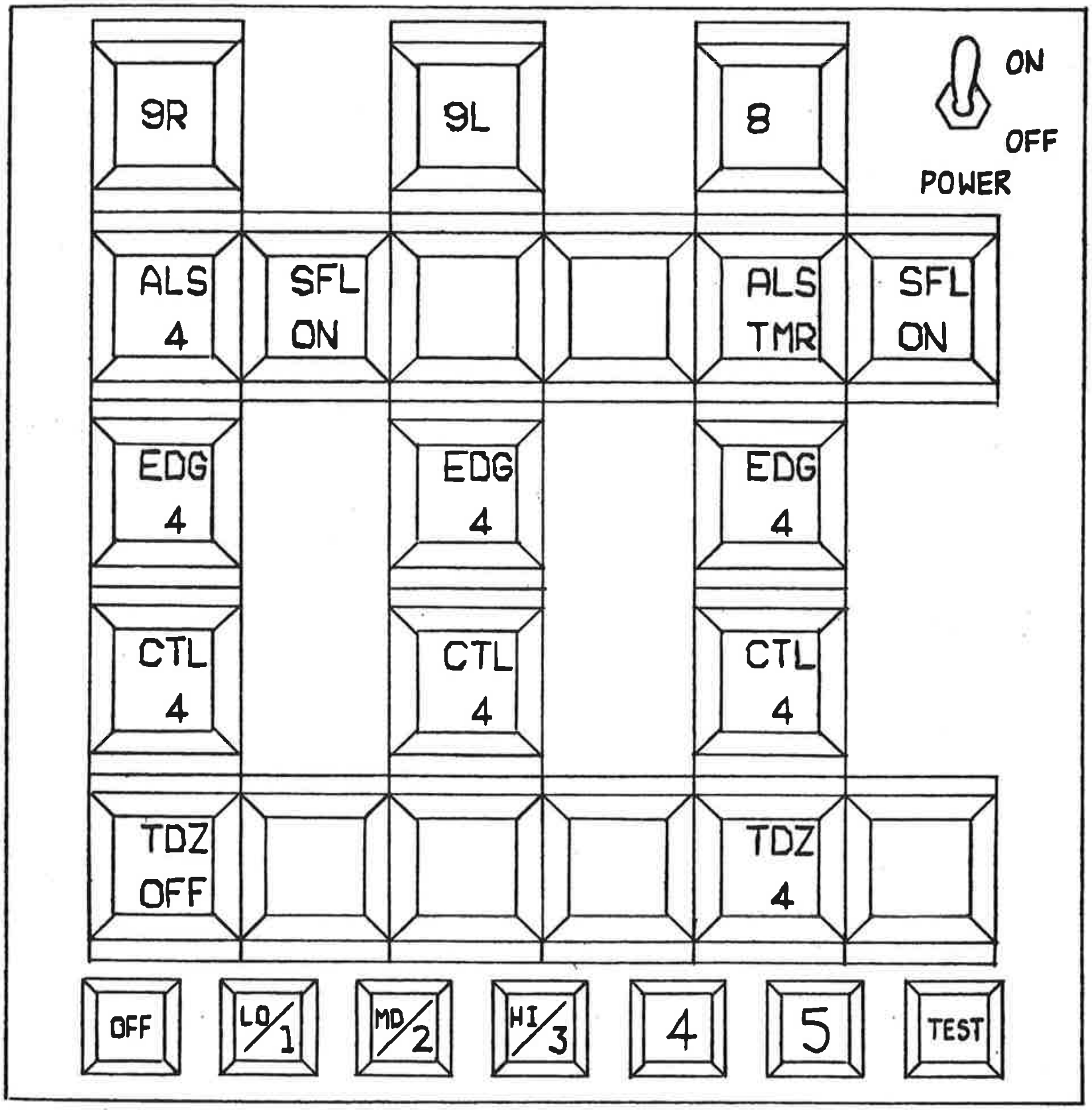


FIGURE 7.4-1. LIGHTING CONTROL PANEL EXAMPLE

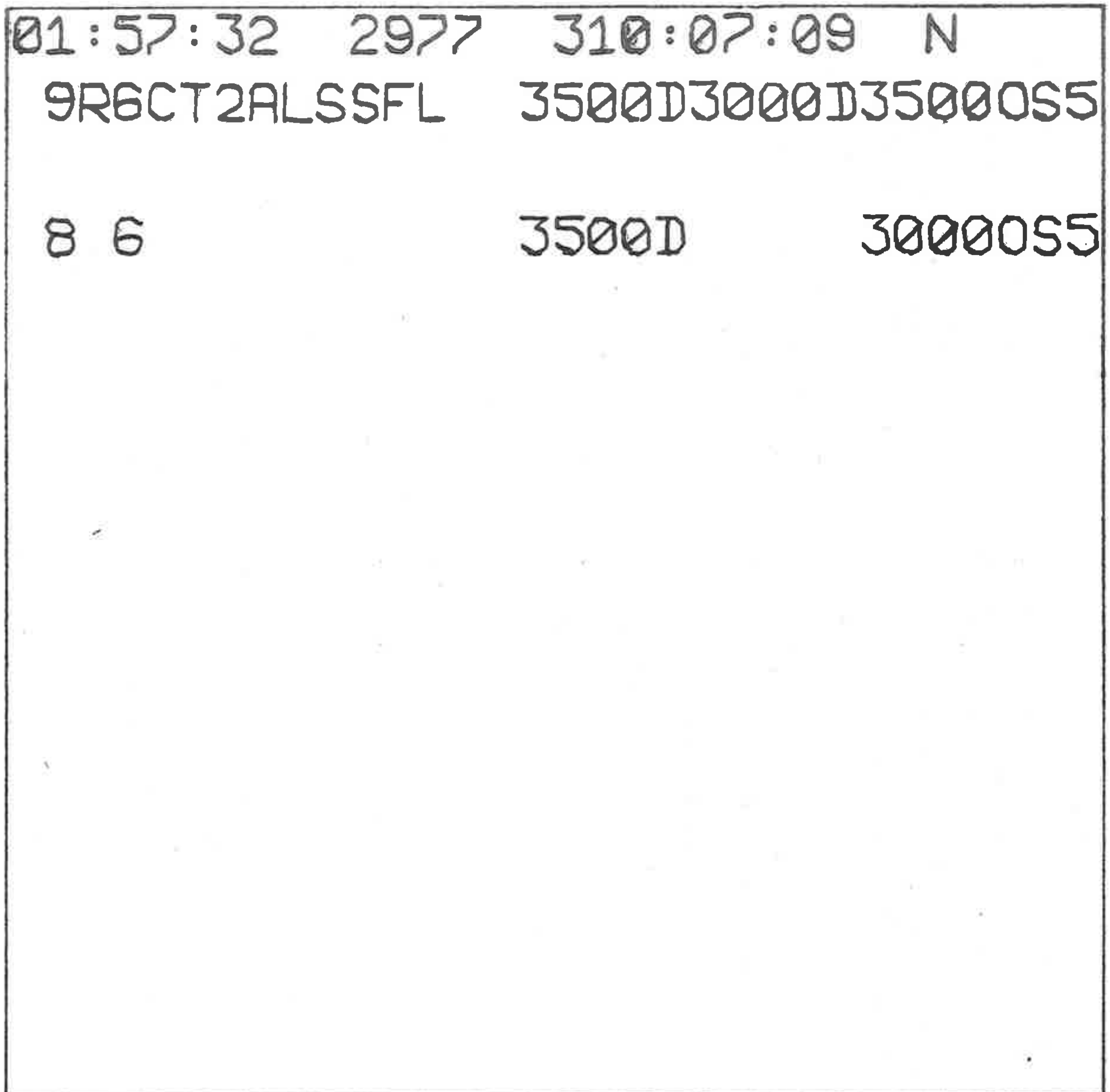


FIGURE 7.5-1. FIXED FORMAT PORTION OF THE TRACON DISPLAY

```
01:57:32  2977  310:07:09  N
 9R6CT2ALSSFL  3500D3000D3500OS5

 8 6                3500D     3000OS5
CRITICAL DISPLAY WEATHER PAGE
SW31009   NW32010   NE31008
SE31010    S32009
ATL RS 0153Z M3V BKN25 OVC
1/2R-F 47/46 CIG 2V4
```

FIGURE 7.5-2. CRITICAL DISPLAY WEATHER PAGE ON THE TRACON DISPLAY

```
01:57:32  2977  310:07:09  N
 9R6CT2ALSSFL  3500D3000D3500OS5


 8 6              3500D     3000OS5
ILS STATUS PAGE
9R ILSCAT2       ][ 8 LOCMAIN
↑  LOCMAIN     PE][ ↑ GS MAIN
   GS STBYMON    ][   IM STBYABN
   IM MAIN       ][   MM OFF
   MM MAIN       ][   OM MAIN
   OM MAIN       ][   LOMMAIN
9L LOCOFF        ][26 LOCOFF
   GS OFF        ][   GS OFF
   MM OFF        ][27LLOCOFF
   LOMOFF        ][   GS OFF
                 ][VOT   MAIN
```

FIGURE 7.5-3. ILS STATUS PAGE ON THE TRACON DISPLAY

8. TERMINAL INFORMATION PROCESSING SYSTEM (TIPS)

The next major step in the evolution of the Flight Data System being considered by the FAA is the replacement of the paper flight strip by electronically displayed flight status information. The system being designed for terminal areas is called the Terminal Information Processing System or TIPS. TIPS will be a computer based system designed to accept, store, process, distribute, and display flight data, as well as other non-radar information for an entire terminal area. TIPS will provide radar controllers with the capability to view flight data directly on their plan view displays and will provide each of the other control positions, that use flight data, with a new flight data display. The FAA has completed the initial design of TIPS and has written the specification for an engineering model. In April 1979, the contract to build the engineering model was awarded.

An all electronic flight data interface will represent a significant departure from the way controllers receive and handle flight status information at their positions today. To better understand the changes that will be introduced by this interface, this study took the TIPS design as it existed in the summer of 1979 and applied it to the operation in the Atlanta TRACON and the Hartsfield Tower Cab. To this end:

1) The current flight data systems at these two facilities were surveyed. The results are presented in Section 4.

2) The most recent TIPS design documentation was reviewed - the TIPS concept is briefly summarized in Section 8.1.

3) The display formats proposed for TIPS were applied to a variety of Atlanta TRACON/Tower Cab positions and then the resulting examples of Atlanta data on the TIPS display were compared with the current utilization of flight status information by these positions - the display format examples versus current data utilization on a position by position basis is presented in Section 8.2 and the findings based on this comparison are presented

in Section 8.3

4) A candidate installation layout for the CCD and TIPS display/data entry equipments was prepared on a position by position basis for these two facilities - the resulting layout and its implications are presented in Section 9.

8.1 TIPS SYSTEM DESCRIPTION

A simplified block diagram of TIPS is presented in Figure 8-1. The central element of the system will be the TIPS Terminal Area Processor. The processor will maintain a data base of flight and other non-radar data (e.g., NOTAMS, airport status, weather data) for the entire terminal area and will provide controllers in the TRACON and client control towers with the portions of this data required by them for the operational situation at the time in the terminal area. The data base will be made up of data provided by the NAS processor at the host En Route Center and of data provided by the terminal controllers via their TIPS data input devices. The Terminal Area Processor will have 3 primary computer to computer interfaces:

NAS Processor Interface - replaces the current interface with FDEP and provides for the exchange of flight data and other non-radar information between the local and national data systems.

TIPS Display Processor Interface - will provide for the exchange of data between the central processor and the individual Air Traffic Control facilities within the terminal area. A display processor will be installed in the TRACON and one additional unit will be installed at each client control tower. Each display processor will maintain the TIPS display presentations at that facility, will process controller inputs, and will permit operational positions to be combined, split, and shifted from one TIPS Display/Data Entry Unit to another within the facility. In the event of a failure in the Terminal Area Processor, the Display Processor at each facility will continue to display the most current data available to the controllers.

ARTS Processor Interface - will permit flight data to be displayed to the radar controllers in the TRACON on their Plan View Displays (PVD) on a quick look basis. Two of

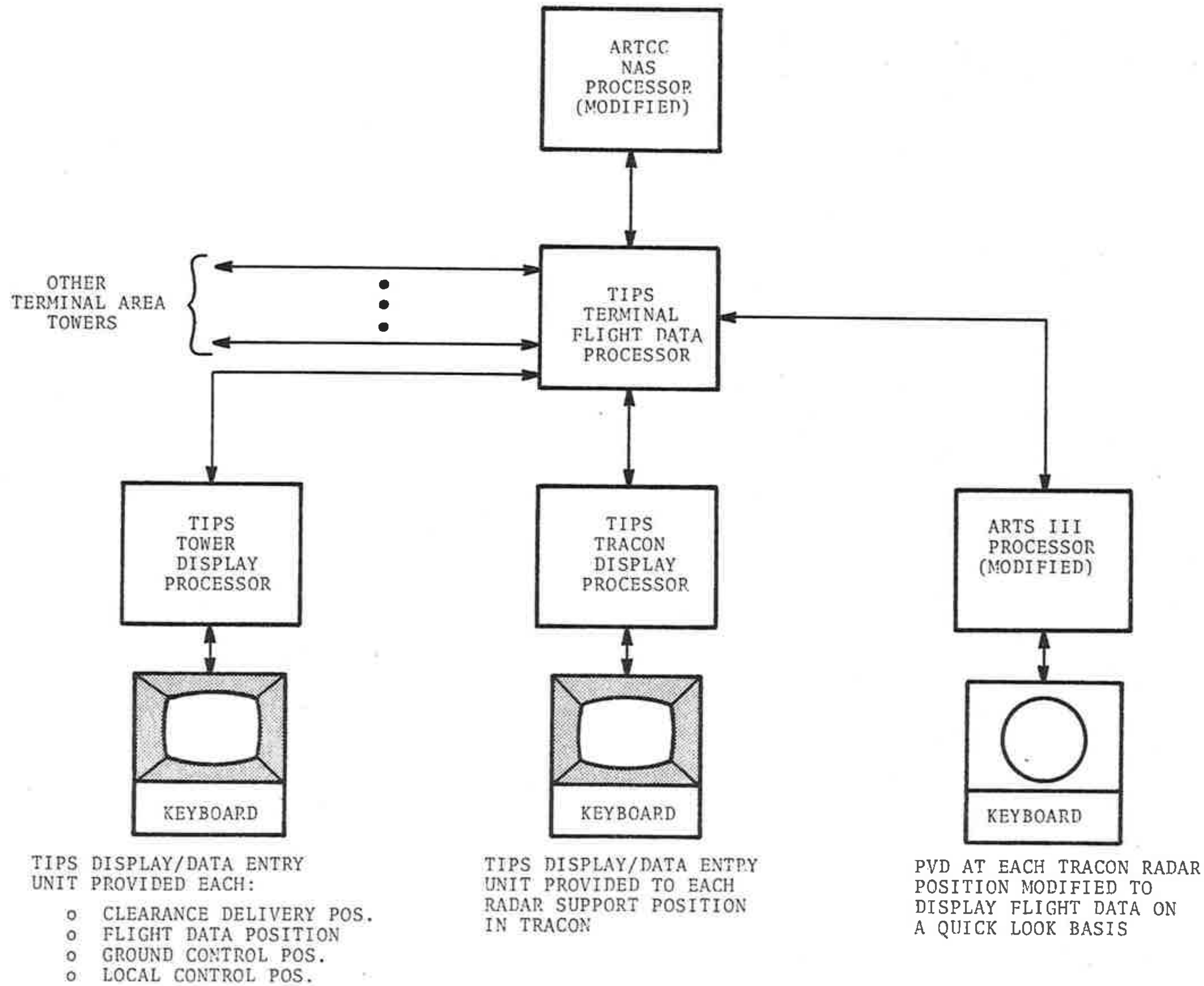


FIGURE 8-1. TIPS/A SIMPLIFIED SYSTEM BLOCK DIAGRAM

the buttons on the existing ARTS Quick Look Panel, located at each radar control position, will be modified to control the display of flight data on the PVD.

Except for the radar control positions, the TIPS Display/ Data Entry Unit will be the controller's interface with TIPS, Figure 8-2. The unit is made up of 4 components:

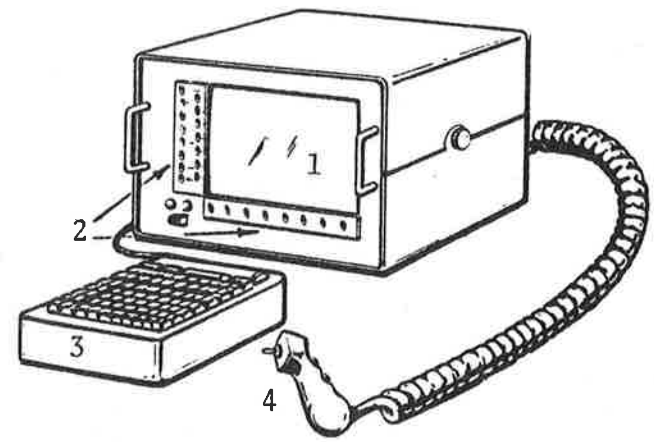
- o CRT Display
- o Quick Action Data Entry Unit
- o Quick Action Hand Control Unit
- o Keyboard

The CRT display will be a stroke written, bright display with a writing surface of approximately 9 by 12 inches. The display housing will be 14 inches in height and depth and 18 inches in width. The mounting options for this housing will be:

- o Console mounted
- o Desk top
- o Trunion type mount that could be installed on the floor, ceiling, or wall.

The general TIPS display format for all positions is presented in Figure 8-3. The lower third of the display will be the same for all positions:

- o Readout Area - used by the controller to display flight plans and requested weather and status information.
- o Preview Area - used by the controller to view data as it is entered from the keyboard.
- o Computer Response Area - used by the computer to notify the controller of the acceptance or non-acceptance of manually entered data.
- o Status Area - displays the presently active runways and notices to airmen
- o Weather Area - displays the local altimeter setting and weather.



(1) TIPS DISPLAY

(2) TIPS QUICK ACTION DATA ENTRY UNIT

(3) TIPS KEYBOARD

(4) TIPS QUICK ACTION HAND CONTROL

FIGURE 8-2. TIPS DISPLAY/DATA ENTRY UNIT

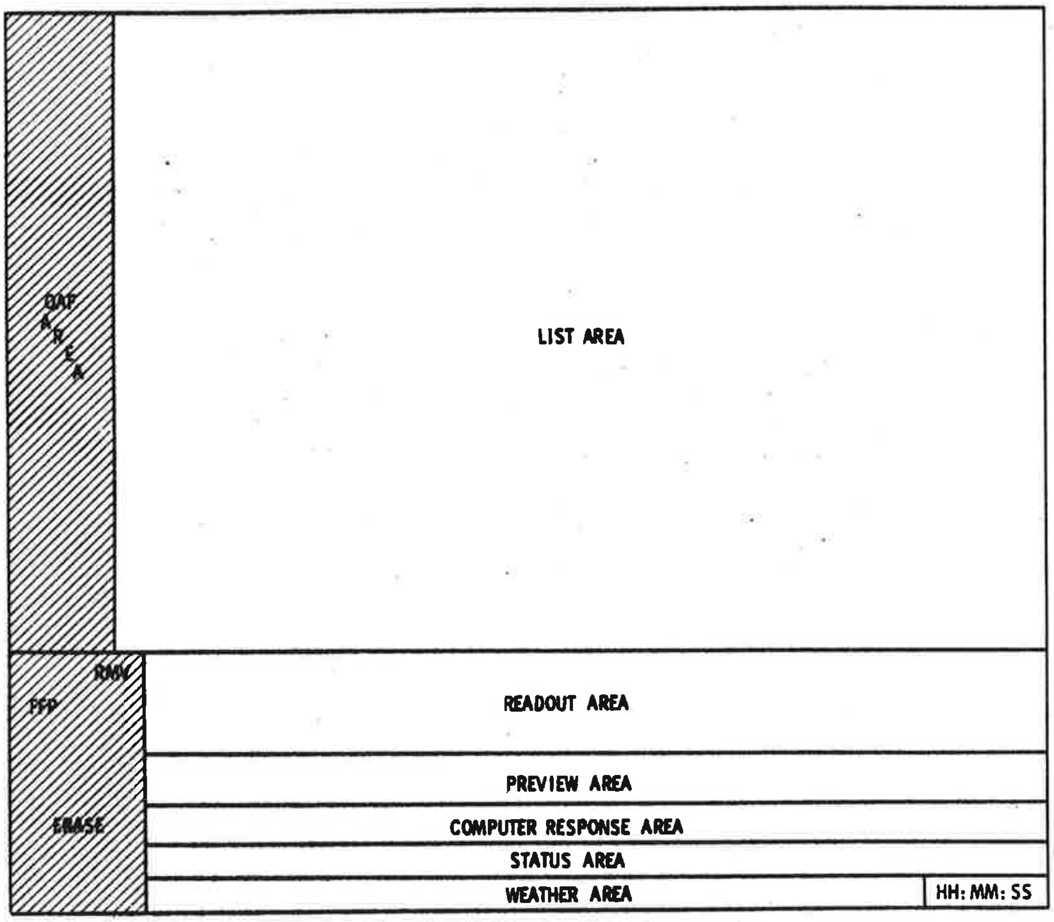


FIGURE 8-3. TIPS DISPLAY PRESENTATION FORMAT

- o Time - is presented in the lower right corner in hours, minutes, and seconds.

The upper two-thirds of the screen is used to display departure and/or arrival flight lists. The shaded areas on the left of the screen are used to list the quick action functions available to the controller.

It is the goal of the Quick Action Data Entry Unit to provide each controller with a quick, flexible method for identifying and acting on specific information that is being displayed. The unit consists of 2 panels of pressure sensitive buttons located on the left side and along the bottom of the display. The simplest method for explaining how this unit would be operated is by an example. Figure 8-4 shows how the TIPS display would appear during a sequence in which a ground controller uses the quick action buttons to request the display of the flight plan for flight ACID 6:

View A - is of the display immediately before any controller action. Two lists with aircraft identities (ACID) are shown. The flight of interest is ACID 6 in the left column.

View B - the controller depresses the switch adjacent to the row in which ACID 6 is listed. Lines are drawn above and below the selected row. If the improper row is selected, the controller can depress another switch and the 2 lines will move to the row adjacent to that switch.

View C - after the proper row has been selected, the controller selects the proper column in which ACID 6 is listed. The selected ACID is then enlarged and brightened and the quick action functions now available to the controller relative to ACID 6 are printed out in the legend area next to the quick action switches.

View D - to examine the ACID 6 flight plan, the controller

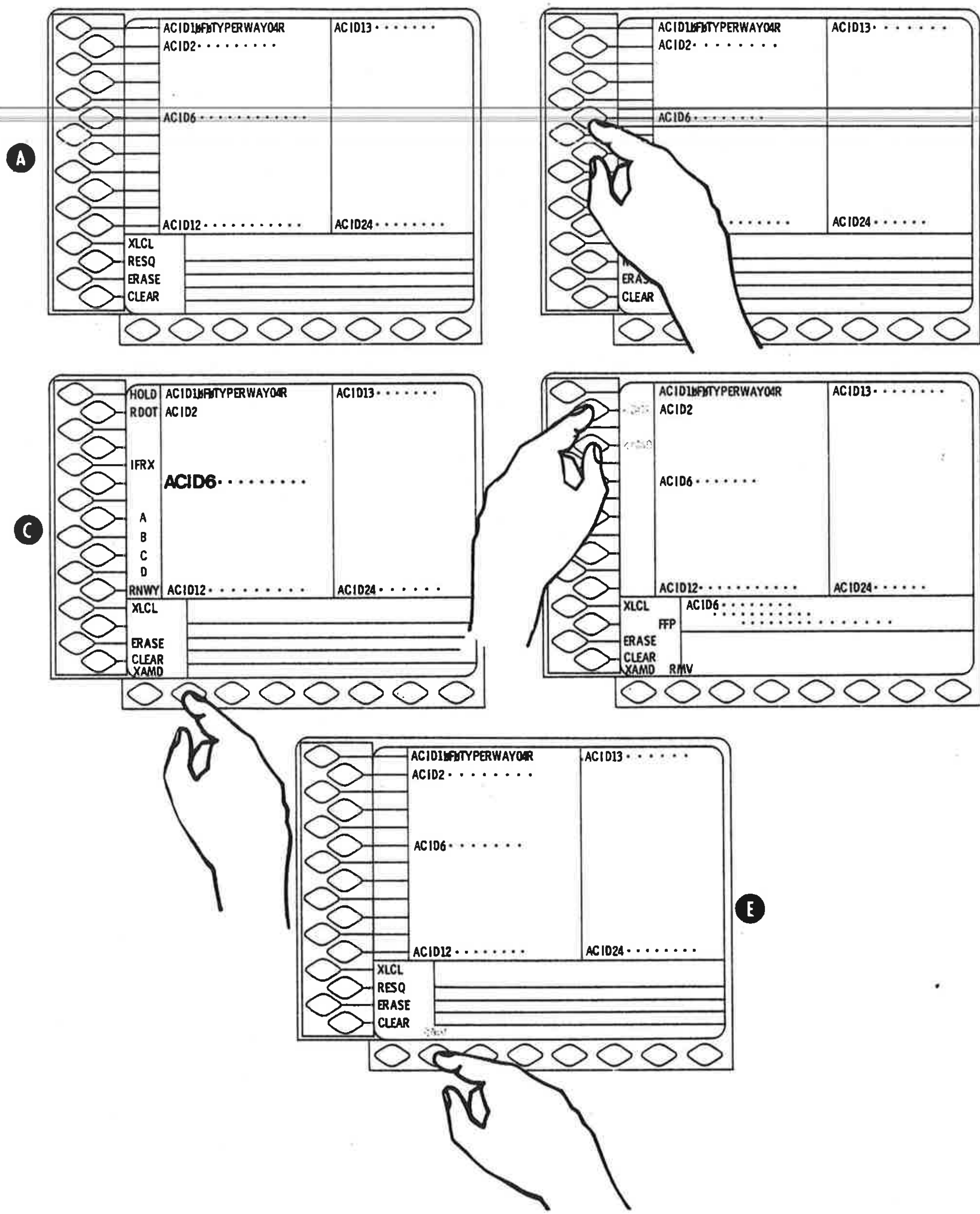


FIGURE 8-4. TIPS QUICK ACTION DATA ENTRY UNIT AND ITS OPERATION

depresses the switch adjacent to RDOT (readout). The flight plan is then displayed and the list of quick-action functions is reduced back to those not requiring the preselection of an ACID.

View E - after the flight plan is examined, the controller can remove the flight plan by depressing RMV or he can directly initiate a different ACID selection by starting the sequence as described in View B.

The point of this example is that controllers should be able to do most of the routine data manipulations by selecting a relatively few buttons as compared to typical keyboard entries - in this example 3 buttons were depressed.

The Quick Action Hand Control Unit, Figure 8-5, will permit both ground and local controllers to range up to 10 feet from the TIPS display and to still be able to operate the quick action functions.

A TIPS keyboard will provide each controller with a full data entry and editing capability. The keyboard will be adapted from the ARTS III keyboard to provide the TIPS functions and capabilities, Figure 8-6.

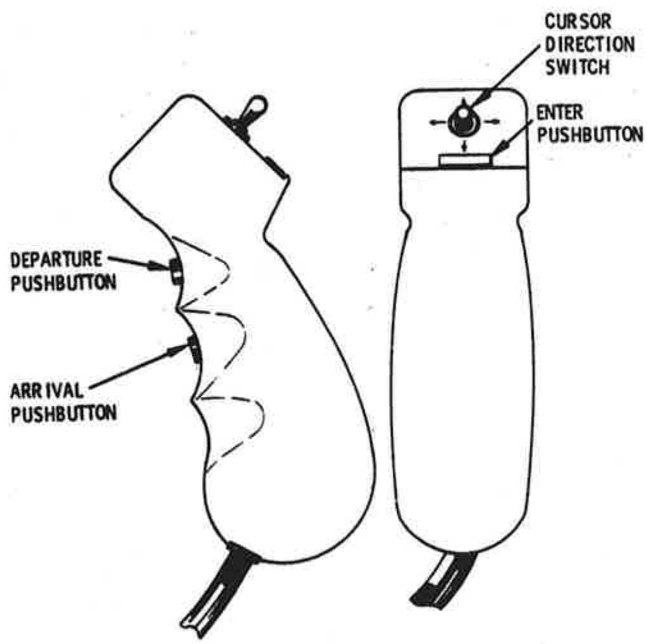


FIGURE 8-5. TIPS QUICK ACTION HAND CONTROL

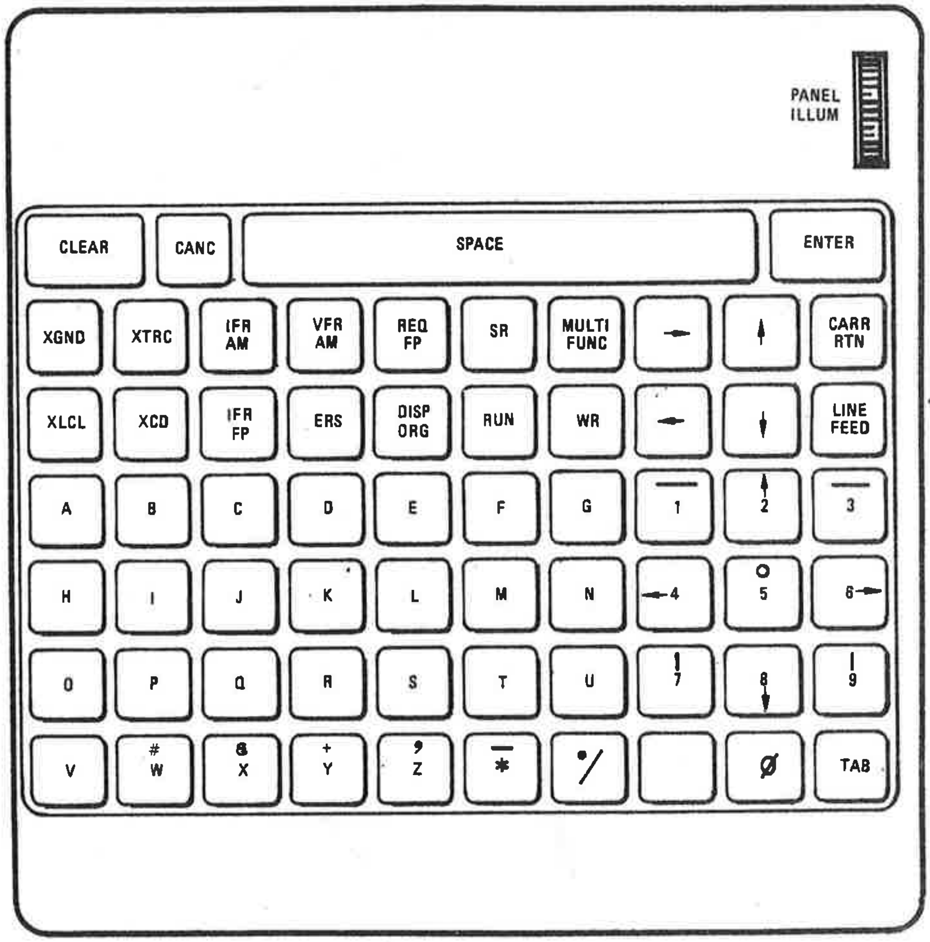


FIGURE 8-6. TIPS KEYBOARD

8.2 TIPS FLIGHT DATA LAYOUT BY POSITION

In subsection 4.4, the current layout of flight data at each Hartsfield-Atlanta Tower Cab/TRACON position was described. Included in the description was a detailed example (i.e., photograph) of the flight data on hand during a busy period for each position. In this subsection, the flight data situations portrayed in those photographs are shown as they would appear on the TIPS display. The resulting TIPS data presentations are then compared to the current data utilization at these positions. Information on current data useage was obtained by means of an interview with an Atlanta controller qualified at all the positions of concern in the Atlanta TRACON/Tower Cab, and in brief discussions with controllers on duty at these positions.

8.2.1 TIPS/Clearance Delivery Position (CD)

The duties and a description of the current flight data layout at the CD position was presented in subsection 4.4.1.1.

8.2.1.1 Example TIPS Presentation for CD

Figure 8-7 shows how TIPS would present the flight data situation portrayed in Figure 4-16 for CD. The flight numbers are listed in five columns and are arranged in alphanumeric order. Other arrangements are available to CD, but the alphanumeric scheme is closest to the one used today. The display area to the right is reserved for flights transferred to CD by either a ground or local control position for amendment. The lower third of the display is the same for all control positions, Figure 8-3. In this example the flight plan for DL407 is being displayed in the Readout Area. The Preview and Computer Response Area are blank. The Status Area provides the information that Taxiway R will be closed south of Runway 26/8 until 2230Z-time. The Weather Area states:

ATL RS 2013Z - special weather report issued for Atlanta at 2013Z- time.

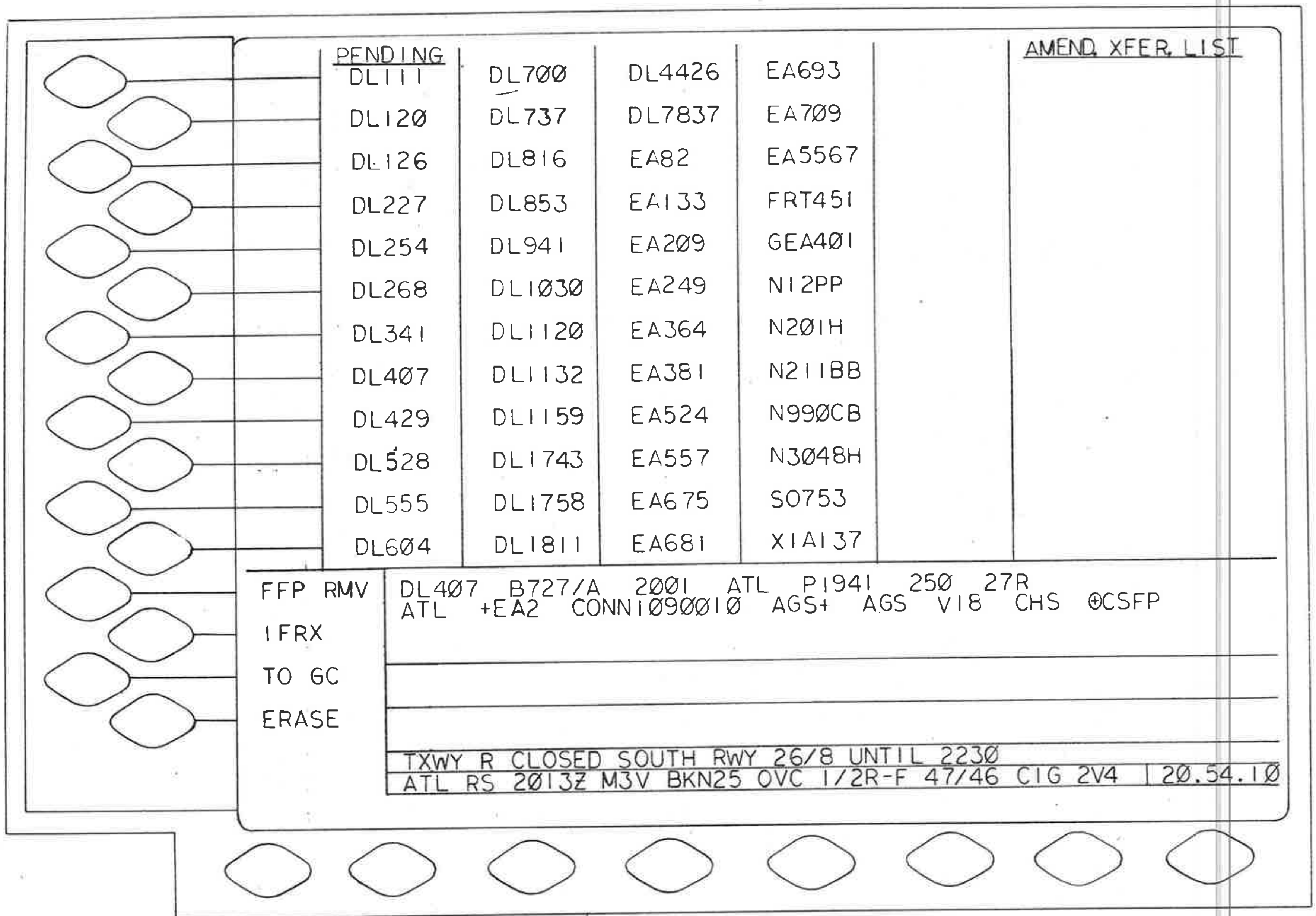


FIGURE 8-7. EXAMPLE TIPS DISPLAY PRESENTATION FOR CLEARANCE DELIVERY (CD) AT ATLANTA

M3V - measured ceiling 300 feet and variable

BKN25 - broken cloud layer at 2500 ft

OVC - overcast

1/2 R-F - half mile visibility in rain and fog

47/46 - temperature and dew point

CIG2V4 - ceiling variable from 200 to 400 ft

The current Z-time is given in the lower, right hand corner in hours, minutes, and seconds. The final box, located on the left, is for those quick entry actions that are available to CD without having to select an aircraft identify first. The quick action functions are:

FFP - permits CD to convert a flight plan shown in the Readout Area from an abbreivated form to a full flight plan or to page the Readout Area if the full flight plan takes up more than 4 lines.

RMV - clears the Flight Plan Readout Area.

IFRX - changes the flight plan displayed in the Readout Area from IFR to VFR status.

TO GC - transfers the flight data currently displayed in the Readout Area to the appropriate ground control position.

ERASE - clears the Computer Response Area.

New departures are added to the Pending List in alphanumerical order some preset time before the flights are scheduled to depart. When a pilot calls CD for clearance, CD will scan the Pending List for the flight number and will then display its flight plan in the Readout Area (e.g., DL407 has been selected in this case). CD will read the clearance to the pilot to the extent necessary and make any necessary changes. The displayed flight plan shows the same information as is printed on the flight strip, Figure 4-16, except for the assigned runway. Today, CD notes the preliminary runway assignment on the flight strip. TIPS will automate the runway assignment requiring CD to make a keyboard input only if the assignment is incorrect. On issuing a clearance, CD will send the flight data to the appropriate ground control position by means of the TO GC quick action. On call-in by a pilot who has not submitted an IFR flight plan, CD would use the keyboard to input the flight data to TIPS instead of making out a handwritten flight strip.

8.2.1.2 CD/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-1 shows the data that CD currently uses routinely or on occasion and then indicates whether TIPS will provide this information in direct view of the controller in the List Area of the display or in the Readout Area on a call-up basis. Ideally, TIPS should provide routinely used data in the List Area and provide occasionally used data on a call-up basis in the Readout Area. Table 8-1 indicates that CD will have to call up routinely used information. However, since CD only pays attention to flights on a one-at-a-time basis as each pilot calls in requesting clearance, the call-up of data at pilot call-in may not inconvenience CD.

TIPS provides CD with all the information to do the clearance delivery portion of his duties. However, TIPS does not permit CD to flag or to note information that Ground Control, Local Control, or Departure Radar should be aware of in handling the flight and, due to workload, may overlook. Appendix A presents a partial list of the types of information noted by CD for use by other controllers:

(1) Uncommon altitude requests flagged

(2) Uncommon departure initial contact points are noted for Ground Control

(3) Pertinent departure weight restrictions on flights are noted

With TIPS, if this information is to be transmitted by CD, it will probably be done verbally, as opposed to written, as it is done today.

Due to the limited size of the List Area, paging of the information in the List Area will be available to the controller. Ideally, since primary flight status information is to be dis-

TABLE 8-1. FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR CLEARANCE DELIVERY

FLIGHT STATUS INFORMATION	CURRENT DATA UTILIZATION ROUTINELY	ON OCCASION
AIRCRAFT IDENTIFICATION	Direct View	
AIRCRAFT TYPE		Call-up
ASSIGNED BEACON CODE	Call-up	
PROPOSED DEPARTURE TIME	Call-up	
REQUESTED ALTITUDE	Call-up	
ROUTE/DESTINATION	Call-up	
DEPARTURE VECTOR AREA	Call-up	
ASSIGNED RUNWAY	Call-up	

played in the List Area, paging should only be required infrequently during the day. For CD, paging of the Pending List will be required during the daily departure peaks. TIPS will hold 60 entries in the Pending List and the current daily maximum is around 75 flight strips, Figure 4-16.

8.2.2 TIPS/Ground Control Positions(GC)

The duties and current flight data layout for the 3 ground control positions was presented in subsection 4.4.1.2.

8.2.2.1 Example TIPS Presentation for GC-2

Figure 8-8 shows how TIPS would present the flight data situation portrayed in Figure 4-17 for GC-2. The List Area displays departure information on the left hand side and information on arrivals on the right hand side. Of the number of list arrangements available to GC, the Arrival List in this example has the arrivals sorted by runway with each new entry added to the bottom of the appropriate sublist - the same as the current arrangement. Arrivals are added to the display on handoff from local control and are deleted from the display when they enter the ramp area by means of the terminate (TERM) quick action button. The entry format in the Arrival List is:

- o Aircraft identity
- o Aircraft type
- o Assigned runway

GC is currently concerned with departures under his control in the taxiway network and with departures in the ramp area that are not yet under control. Unlike most airports, control of traffic in the ramp areas between the taxiway network and the gates is handled by airline controller personnel at Hartsfield-Atlanta. Currently, CD hands off departure flight strips to GC immediately after clearance is read, and it is usually minutes before the departures call in for taxi instructions. These inactive or pending flights are stored by GC in trays A and B in Figure 4-17. Today, GC uses these strips for planning purposes.

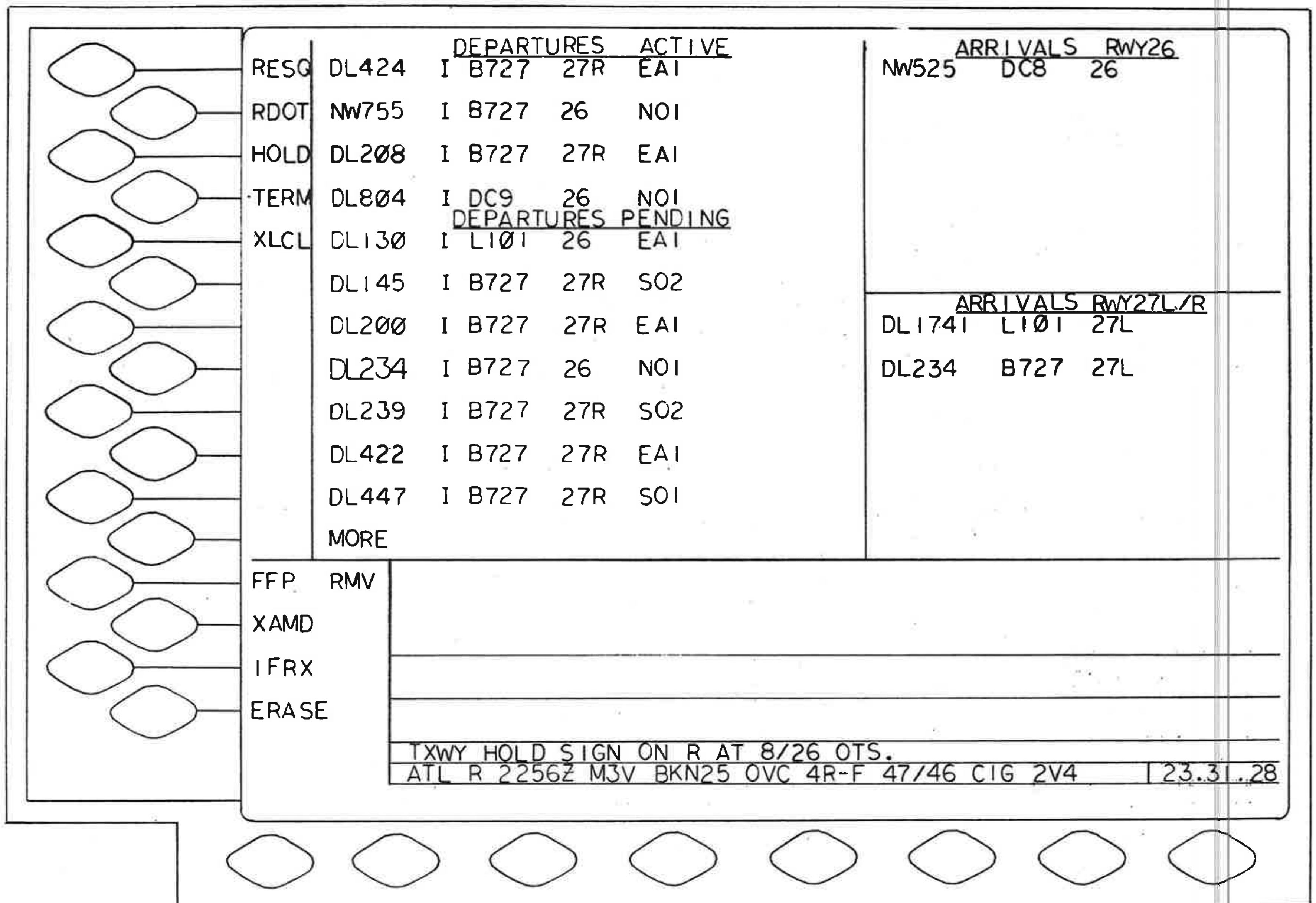


FIGURE 8-8. EXAMPLE TIPS DISPLAY PRESENTATION FOR GROUND CONTROL (GC-2) AT ATLANTA

It is not uncommon for GC to make notations on these strips, such as changing runway assignments, and then to cock the strips in the trays to note that special attention will be required for these flights when the pilots call in for taxi instructions. On pilot call in, GC transfers the strip to tray C where the active flight strips are kept. The point of this discussion is that the display format proposed by TIPS for GC would mix the pending with the active departures in the Departure List.

The format is shown in Figure 8-8 and would operate as follows. The pending departures are listed below the list of active departures. To minimize the extent paging would be required of the Pending List, the start position of the list would automatically self adjust so no vacant slots would exist between the Pending and the Active Departure Lists. On handoff from CD, the departure is listed in the Pending List in alphabetical order. At pilot call-in, GC-2 would scan down the Pending List for the flight number and would then shift the flight to the Active List by measn of the resequence (RESQ), quick action. In Figure 8-8, the DL234 ACID is enlarged in the Pending List indicating GC-2 has selected it for quick action. To transfer DL234 to the Active List, GC-2 would depress the resequence (RESQ) quick action switch and then select the ACID below which is to be placed - namely DL804. This sequence would cause the Pending List to drop down one entry on the display and would cause the DL234 entry to be entered below DL804. At handoff to Local Control, GC-2 would select the corresponding flight number on TIPS and would use the XLCL quick action entry to transfer the flight data to the appropriate Local Control position.

The entry format for the Departure List is:

- Aircraft identify
- IFR/VFR flight status code
- Aircraft type
- Assigned runway
- Coordination fix for IFR flights (i.e., which Atlanta

terminal area departure gate is to be used, Figure 2-1) or heading for VFR flights

8.2.2.2 GC/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-2 presents the current flight status information useage for GC and the proposed TIPS presentation of that data. The Table makes two points clear; GC uses a considerable amount of data routinely, and TIPS will display that data which it contains on these flights on direct view to GC in the List Area. The second point is that TIPS, as currently envisioned, will not be able to provide all the flight status information that GC currently obtains:

1) CD will no longer have a means of notifying GC when a departure will be making initial contact with GC from a point on the airport surface other than the expected location (Figure 2-3) - this is currently done via flight strip notation from CD to GC (e.g., Figure A-2, flight strip 11).

2) TIPS will not provide GC with a means to note runway 8/26 crossing status. A relatively complex task at Atlanta due to the close proximity of the runway to the terminal gate area. Today, flight strips and the scratch pad provide GC with this means for departures and arrivals respectively.

3) TIPS will not provide GC with a means to note that initial contact has been made for arrivals. Today the scratch pad provides GC with this means.

4) GC makes flight status changes today and then notifies the pilots at initial contact of these changes. Assuming that TIPS will be made to provide a Pending Departure List, TIPS may have difficulty providing GC with a means to flag flights for which changes have been made or to flag the changes themselves. Today GC cocks the strips in the trays to note that a change has been made

TABLE 8-2. FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR GROUND CONTROL

FLIGHT STATUS INFORMATION	CURRENT DATA UTILIZATION ROUTINELY	ON OCCASION
FOR DEPARTURES		
Aircraft Identification	Direct View	
Aircraft Type	Direct View	
Departure Vector Area	Direct View	
Assigned Runway	Direct View	
Runway Crossing Status	Not Provided	
Location Departure to be Found at Initial Call-in		Not Provided
FOR ARRIVALS		
Aircraft Identification	Direct View	
Assigned Runway	Direct View	
Runway Crossing Status	Not Provided	
Initial Contact Status	Not Provided	

and then can readily identify the changes made at pilot call-in by looking for the marked item on the flight strip. The strips in trays A and B, Figure 4-17, provide numerous examples of this flight strip useage.

Paging of the Arrival List should be infrequent. However, paging of the Departure List will probably occur throughout the day. The capacity of the first page of the Departure List is 12 entries. The current typical daily maximums are 10 active departures and 30 pending departures for a total demand of 40 departures, Figure 4-17. Not only will paging be frequent, the Departure List may extend over 3 to 4 pages during departure peaks.

8.2.3 TIPS/Local Control Positions (LC)

The duties and current flight data layouts for the 3 local control positions was presented in subsection 4.4.1.3.

8.2.3.1 Example TIPS Presentation for LC-3

Figure 8-9 shows how TIPS would present the flight data situation portrayed in Figure 4-21 to LC-3. The entry formats for LC are similar to those provided GC with a couple of additions:

Departure List Additions

- o Assigned beacon code (e.g., 5233 in Figure 8-9)
- o Requested Altitude (e.g., 160)

Arrival List Additions

- o Assigned beacon code (e.g., 2033)
- o Approach type (e.g., I for an ILS approach)

A TIPS handoff of a departure from GC causes the flight to be added to the bottom of the Departure List on the LC display. The flights automatically work their way to the top of the list as departures are handed off to the TRACON. The top entry in the list is the next departure. To handoff flight data to the TRACON, the aircraft ID is selected (e.g., DL107 has been

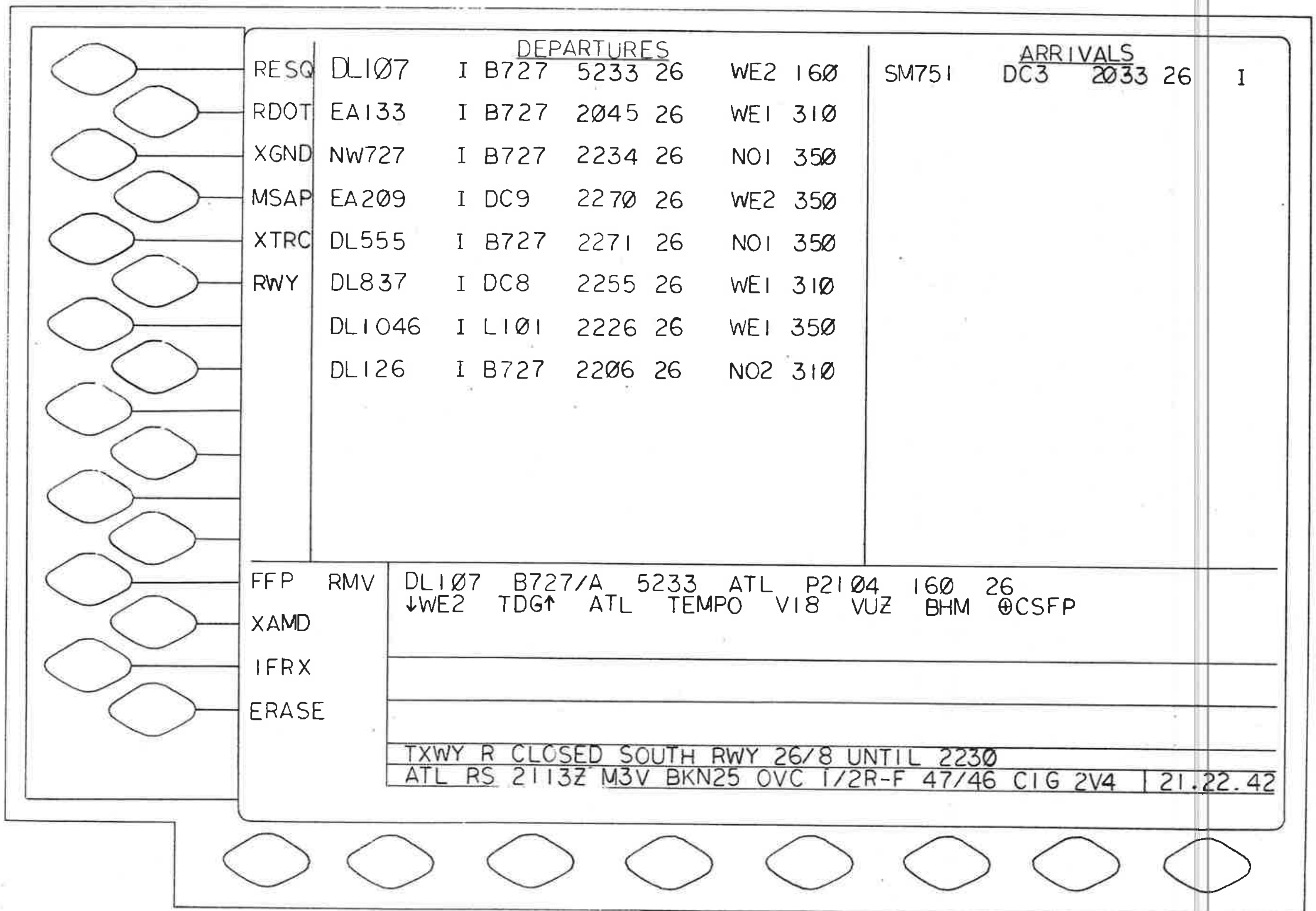


FIGURE 8-9. EXAMPLE TIPS DISPLAY PRESENTATION FOR LOCAL CONTROL (LC-3) AT ATLANTA

selected in Figure 8-9), and the XTRC quick action switch is depressed. The TIPS computer will use the same cues as the controllers in determining which position should get the flight data at handoff in the routine case. In this example, DL107 in Figure 8-9 would be routed to DR-3, who handles the departures using the WE2 (i.e., West 2) gate to exit from the terminal area.

For arrivals, an entry is added to the Arrival List on handoff from Final Control in the TRACON. Entries are deleted by using the handoff to GC quick action (i.e., XGND).

8.2.3.2 LC/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-3 compares current data useage with the proposed TIPS presentation of that data for LC. The situation is similar to the one discussed for GC. TIPS will present the data that LC uses with some frequency in the List Area if it is available, but there will be some data currently used that will not be provided by TIPS. TIPS will not provide LC with a means to note

1) Position and hold status of departures (currently provided by cocking the flight strip in the tray)
2) Takeoff clearance status of departures (currently noted by a check mark on a scratch pad)
3) Landing clearance status of arrivals (noted today by a check mark on a scratch pad).

Paging should be an infrequent occurrence at the local control positions.

8.2.4 TIPS/Terminal Arrival Radar(TAR) and Handoff(AH) Positions

The TAR and AH positions operate as a team and so are presented here together. The duties and current flight data layouts for the 2 pair of TAR/AH positions operational at Atlanta are presented in subsection 4.4.2.1.

TABLE 8-3. FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR LOCAL CONTROL

FLIGHT STATUS INFORMATION	CURRENT DATA UTILIZATION ROUTINELY	ON OCCASION
FOR DEPARTURES		
Aircraft Identification	Direct View	
Aircraft Type	Direct View	
Assigned Beacon Code		Direct View
Departure Vector Area	Direct View	
Assigned Runway	Direct View	
Position and Hold Status	Not Provided	
Takeoff Clearance Status	Not Provided	
FOR ARRIVALS		
Aircraft Identification	Direct View	
Aircraft Type	Direct View	
Assigned Runway	Direct View	
Landing Clearance Status	Not Provided	

8.2.4.1 Example TIPS Presentation for TAR-2/AH-2

Each handoff position in the TRACON will be provided with a TIPS display and data entry unit identical to the units found in the Tower Cab. Figure 8-10 shows how TIPS would present the flight data shown in Figure 4-22 to AH-2.

Some preset time before arrivals are scheduled to arrive at the coordination fixes, their flight numbers will be displayed on the AH TIPS display. On the display, the arrivals are sorted by coordination fix and then by their expected times of arrival at the fixes. In Figure 8-10, Dalas and Logen are the fixes of interest to AH-2. AH would use the TIPS unit to verify the TIPS generated runway assignments, to enter pop-up arrivals into the TIPS data base (about 34 per day, Table 4-3), and to make any flight data modifications required by the TAR position being supported.

In contrast with the handoff positions in the TRACON, the radar control positions will have flight data made available to them on their ARTS Plan View Displays (PVD) on a quick look basis. Two of the existing buttons on the ARTS quick look panel, located between the ARTS trackball and keyboard panels, will be modified to perform this function. One button will provide a quick look at fix and altitude information of all flights with displayed data blocks or displayed in the Arrival/Departure Table or in the Coast/Suspend List. The second button will cause aircraft data, such as aircraft type and beacon code, to be displayed. Figure 8-11 shows how these two buttons would modify the data content of an arrival listed in the Arrival/Departure Table, and Figure 8-12 shows their effect on an arrival target's data block. In keeping with this idea of putting flight data on the PVD, Atlanta has already modified their ARTS software to permit aircraft type to be displayed to radar controllers today. Aircraft type is displayed in an alternating fashion (at 3 second intervals) with ground speed in the data blocks.

At initial call-in by an arrival, TAR would push the Fix/ Altitude Button to verify the arrivals coordination fix, destina-

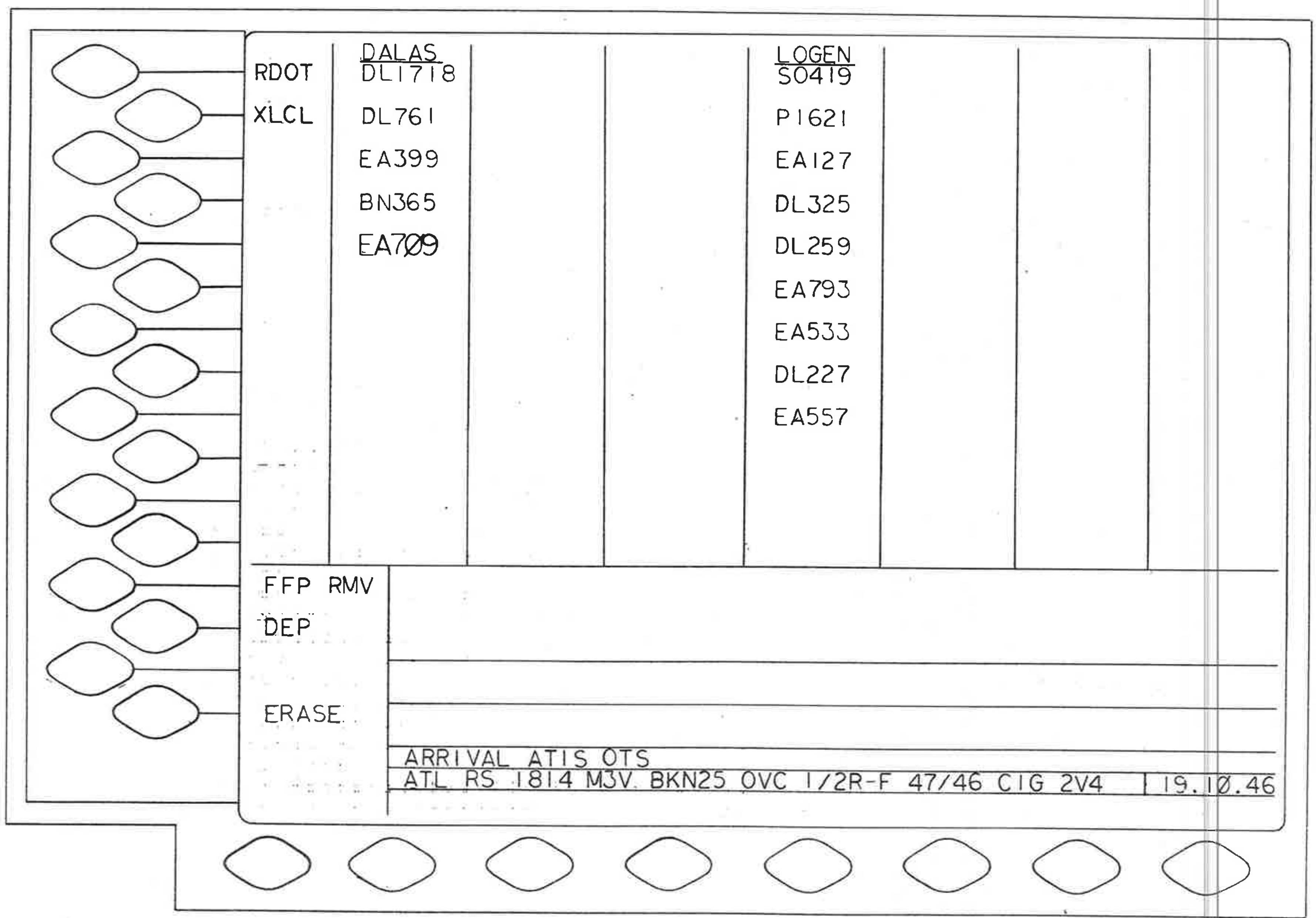


FIGURE 8-10. EXAMPLE TIPS DISPLAY PRESENTATION FOR ARRIVAL HANDOFF (AH-2) AT ATLANTA

NORMAL MODE

L	EA244	1043	P
↑	↑	↑	↑
TAD	FLT. No.	BEACON CODE	ARRIVAL DESIGNATOR

FIX/ALTITUDE MODE (A QUICK LOOK MODE)

L	EA244	120	HUSKY	A2126	ATL
↑	↑	↑	↑	↑	↑
TAD	FLT. NO.	ASSIGNED ALTITUDE	COORDINATION FIX	ETA AT COORDINATION FIX	DESTINATION

AIRCRAFT DATA MODE (A QUICK LOOK MODE)

L	EA244	B727	1043
↑	↑	↑	↑
TAD	FLT.NO.	AIRCRAFT TYPE	BEACON CODE

FIGURE 8-11. QUICK LOOK FLIGHT DATA OPTIONS PROVIDED BY TIPS TO RADAR CONTROLLERS RELATIVE TO ARRIVAL TABLE ENTRIES ON THE ARTS PLAN VIEW DISPLAY (REFERENCE FIGURE 4-11)

NORMAL MODE

EA244
060 21 ← CURRENT GROUND SPEED
CURRENT ALTITUDE (AIRCRAFT TYPE SHOWN ON AN ALTERNATING BASIS AT ATLANTA)

FIX/ALTITUDE MODE (A QUICK LOOK MODE)

EA244
ATL ← DESTINATION
HUSKY 27R ← ASSIGNED RUNWAY
COORDINATION FIX

AIRCRAFT DATA MODE (A QUICK LOOK MODE)

EA 244
1043 ← BEACON CODE
B727 ← AIRCRAFT TYPE

FIGURE 8-12. QUICK LOOK FLIGHT DATA OPTIONS PROVIDED BY TIPS TO RADAR CONTROLLERS RELATIVE TO ARRIVAL DATA BLOCKS ON THE ARTS PLAN VIEW DISPLAY (REFERENCE FIGURE 4-11) tion, and runway assignment. If the runway assignment was found to be incorrect, AH would be requested to make the correction via the TIPS keyboard.

The flight data handoff by TAR to final control will probably be made via ARTS in conjunction with the ARTS handoff. However, AH would still display the flight until its handoff to local control in case assistance in handling the arrival is required during that time and in order to make the TIPS handoff of the flight to local control. Today final control does not make an ARTS handoff to local control.

8.2.4.2 TAR-AH/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-4 makes this comparison for both the TAR and AH positions. Both positions will probably be using the call-up function to obtain routinely used information one or more times for each operation. TIPS will not provide TAR/AH with the means to note:

1) Altitude instructions issued (currently noted on their flight strips)

2) Heading and speed instructions issued (currently noted on their flight strips when the instructions are out of the ordinary)

3) Expect further clearance/expect approach clearance time estimate advisories to pilots (these times are noted today on their flight strips)

With only two approach fixes of concern per AH position, paging of the List Area will only be necessary infrequently.

8.2.5 TIPS/Final Control (AR) and Monitor (MON) Positions

These two positions are treated here together because their flight data requirements are similar and minimal. The duties and current flight data layouts of the AR and MON positions were presented in subsections 4.4.2.2 and 4.4.2.3, respectively.

TABLE 8-4. FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR THE TERMINAL ARRIVAL RADAR AND HANDOFF POSITIONS

FLIGHT STATUS INFORMATION	CURRENT TAR DATA UTILIZATION		CURRENT AH DATA UTILIZATION	
	ROUTINELY	ON OCCASION	ROUTINELY	ON OCCASION
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code		Call-Up		Call-Up
Coordination Fix	Call-Up		Direct View	
ETA at Coordination Fix		Call-Up		Call-Up
Destination Airport	Call-Up		Call-Up	
Altitude Instructions	Not Provided		Not Provided	
Heading/Speed Instructions		Not Provided		Not Provided
Expect Further Clearance/Expect Approach Clearance Advisories To Pilots		Not Provided		Not Provided
Runway Assignment	Call-Up		Call-Up	

8.2.5.1 TIPS Presentation for the AR and MON Positions

Concerning flight status information, these two positions only use aircraft identity and aircraft type today. TIPS will provide these two positions with the quick look capability described for the TAR positions. However, since aircraft identity/type are currently displayed on their plan view displays, the TIPS quick look functions will probably be used infrequently.

To handoff an arrival to local control, AR would probably request the appropriate AH position to make the handoff via his TIPS display and data entry unit. The AH controller would make the handoff via the XLCL quick action function, Figure 8-10.

8.2.5.2 AR-MON/Current Data Useage Compared to the Proposed TIPS Data Presentation

ARTS currently satisfies the flight data requirements of these 2 positions, and TIPS will only enhance the present flight data capabilities of ARTS.

8.2.6 TIPS/Satellite Radar (SAT) and Handoff (SATH) Positions

As in the case of the TAR/AH positions, the SAT and SATH positions operate as a team and so are presented here together. The duties and current flight data layouts of the SAT/SATH positions are presented in subsection 4.4.2.5. From Table 4-3, it is seen that the satellite controllers handle the full range of terminal area operations and that nearly 20 percent of their operations require handwritten flight strips.

8.2.6.1 Example TIPS Presentation for SAT-2/SATH-2

The SAT/SATH positions handle departures, arrivals, and overflights. To handle this variety of flights on the SATH TIPS display, TIPS proposes to provide two List Area presentations, one for arrivals and overflights and the other for departures, and then to permit the controller to switch as needed from one presentation to the other by means of a quick action function.

As an illustration, Figure 8-13 shows how TIPS would present the flight data on the arrivals and overflights in Figure 4-30 to SATH-2. The flights are sorted by coordination fix and then are listed by the expected time of arrival at the coordination fix. Each flight number is preceeded by a one letter code that indicates flight type:

P - an arrival to PDK (Dekalb Peachtree Airport)

F - an arrival to FTY (Charlie Brown County Airport)

V - an overflight

At initial contact by an arrival, SAT-2 would use his quick look Fix/Altitude button to familarize himself with the flight. Then he would note on a scratch pad the arrival's flight number and the type of approach to be made. SATH-2 will then take this information and coordinate it with the control tower. SATH would do this by first calling-up the arrival's flight plan onto his TIPS display and then contacting the satellite airport's control tower. SATH-2 would advise the tower of the arrival's flight number, aircraft type, the ETA or distance to the airport, and would confirm the TIPS generated runway assignment. Finally, SATH-2 would put a check mark on the scratch pad by the arrival's flight number to indicate to SAT-2 that the arrival had been properly coordinated.

If this arrival contact is followed by a request from a tower cab at a satellite airport for permission to release a departure, SATH-2 would then page the List Area on his TIPS display from the arrival/overflight format to the departure format by means of the DEP quick action function, Figure 8-13. Figure 8-14 shows how TIPS would present the flight data on the departures in Figure 4-30 to SATH-2. The flights are sorted by departure airport and are then listed alphanumerically by flight number. SATH-2 would call-up the flight plan of the departure into the Readout Area of the display. In the ensuing coordination between tower cab and TRACON AH would:

1) Confirm that the computer generated departure runway

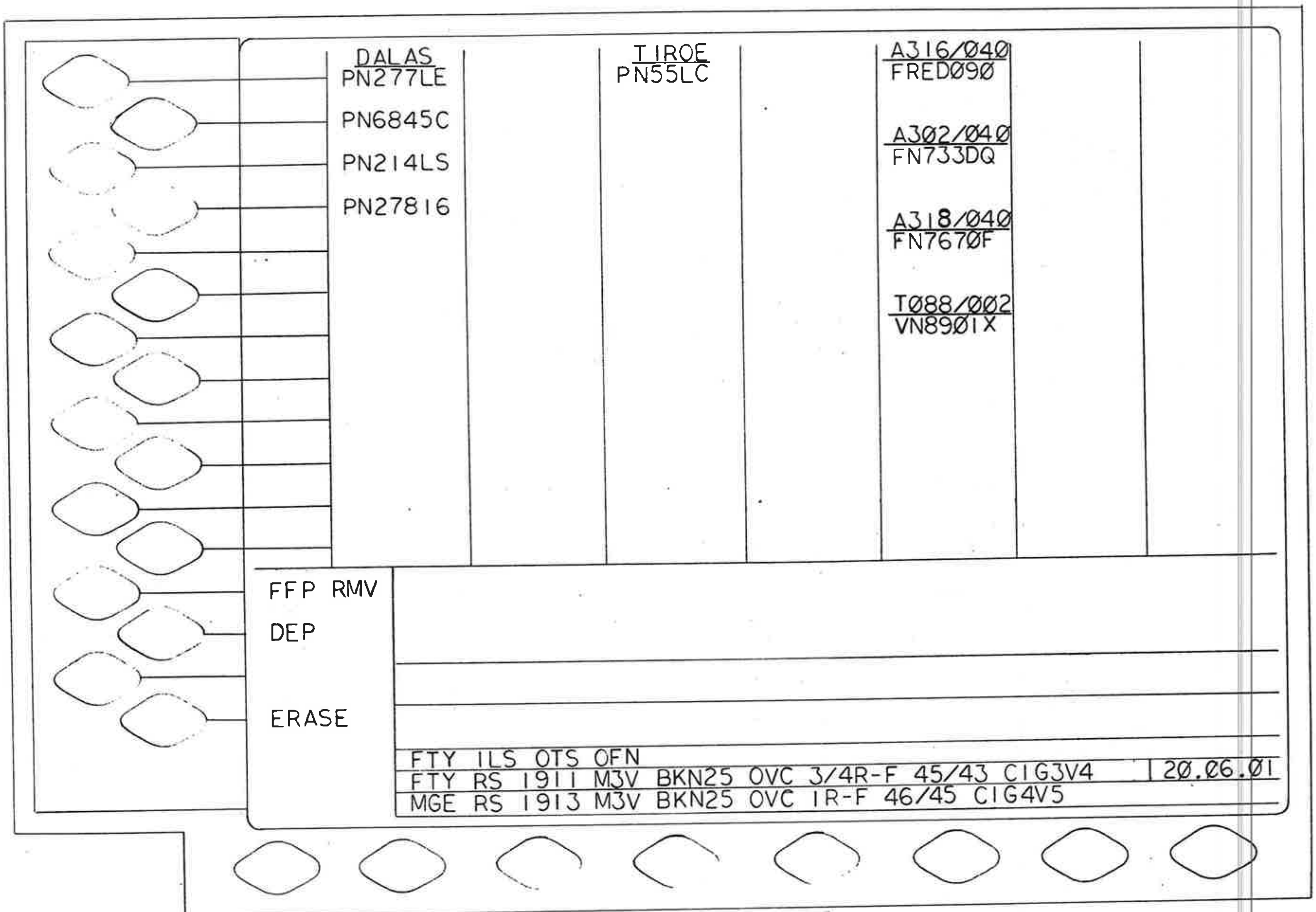


FIGURE 8-13. EXAMPLE TIPS DISPLAY PRESENTATION FOR SATELLITE HANDOFF (SATH-2) AT ATLANTA FOR ARRIVALS AND OVERFLIGHTS

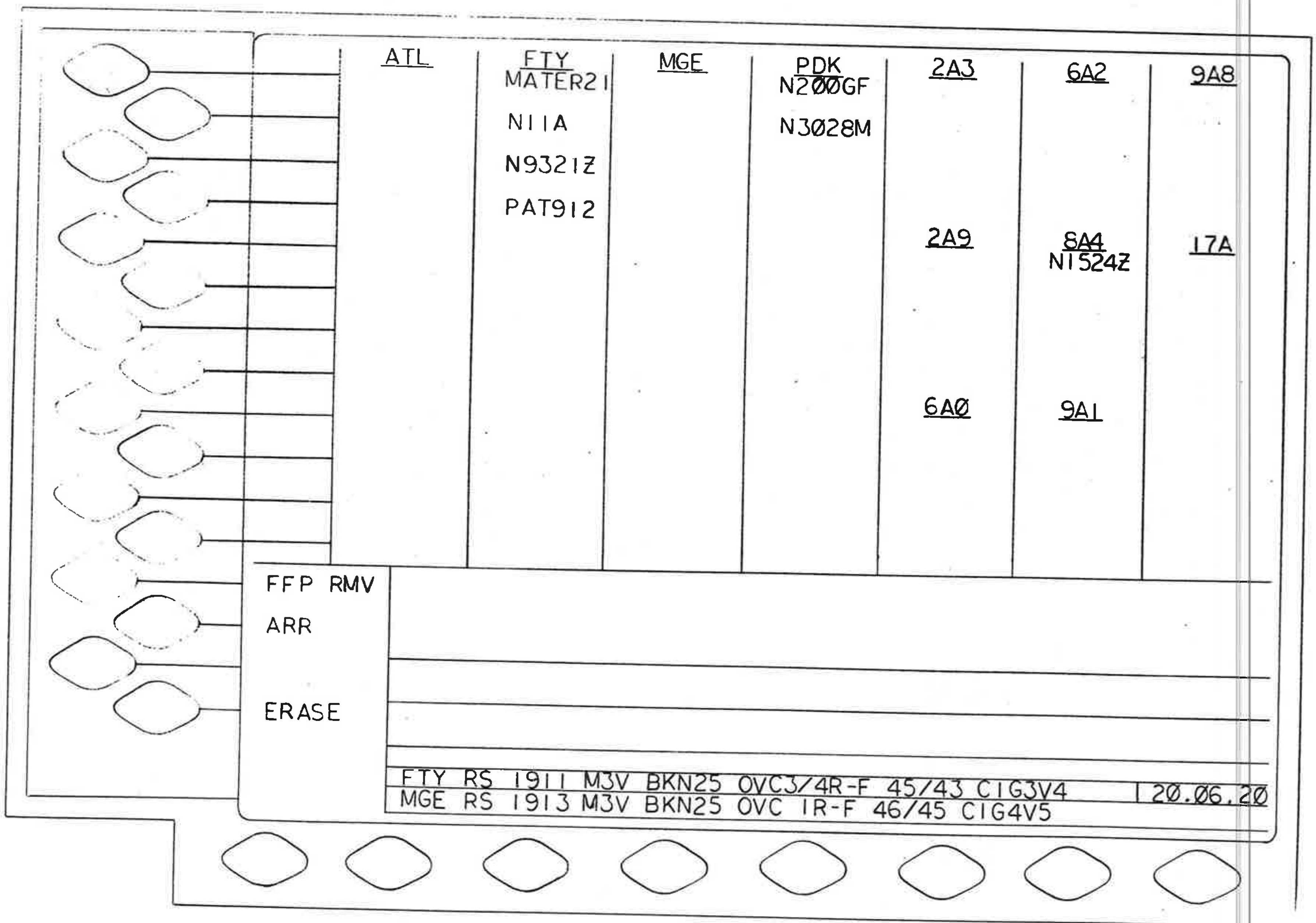


FIGURE 8-14. EXAMPLE TIPS DISPLAY PRESENTATION FOR SATELLITE HANDOFF (SATH-2) AT ATLANTA FOR DEPARTURES

assignment is correct

2) Probably instruct the tower to issue a specific heading instruction to the pilot prior to handoff of the flight to the TRACON (e.g., right turn to 240°)

3) Note on a scratch pad, the flight number and the RT240 instruction

4) Issue the departure release

5) Place the scratch pad so SAT-2 can read the entry.

At departure liftoff, the tower cab once again contracts SATH and states:

1) The liftoff time (noted by SATH on the scratch pad)

2) The initial altitude/heading instructions issued.

At initial contact by the departure, SAT will scan the flight status information on the scratch pad and will use his quick look functions to familarize himself with the flight.

Today, SATH-2 posts weather reports from Charlie Brown County Airport (FTY) and Dobbins Air Force Base (MGE) at his position. With TIPS, these reports would be displayed in an expanded Weather Area, Figure 8-14.

8.2.6.2 SAT-SATH/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-5 makes this comparison for both these positions relative to arrivals and overflights. Both positions will be using the call-up function to obtain routinely used information one or more times per operation. TIPS will not provide SAT/SATH with the means to note:

1) Altitude instructions issued

2) Heading/speed instructions issued

3) Approach type to be used

4) Coordination status with tower concerning arrivals

TABLE 8-5. ARRIVAL/OVERFLIGHT FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR THE SATELLITE RADAR AND HANDOFF POSITIONS

FLIGHT STATUS INFORMATION	CURRENT SAT DATA UTILIZATION		CURRENT SATH DATA UTILIZATION	
	ROUTINELY	ON OCCASION	ROUTINELY	ON OCCASION
FOR ARRIVALS				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code		Call-Up		Call-Up
Coordination Fix	Call-Up		Direct View	
ETA at Coordination Fix		Call-Up		Call-Up
Destination Airport	Call-Up		Direct View	
Altitude Instructions	Not Provided		Not Provided	
Heading/Speed Instructions		Not Provided		Not Provided
Approach Type	Not Provided		Not Provided	
Coordination Status with Tower	Not Provided		Not Provided	
Runway Assignment	Call-Up		Call-Up	
Expect Further Clearance/Expect Approach Clearance Advisories To Pilots		Not Provided		Not Provided
FOR OVERFLIGHTS				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code	Call-Up		Call-Up	
Coordination Fix	Call-Up		Direct View	
Facility to Which Flight data Forwarded	Call-Up		Call-Up	
ETA at Coordination Fix	Call-Up		Call-Up	
Requested Altitude	Call-Up		Call-Up	
Requested Route Through Terminal Area	Call-Up		Call-Up	
Overflight Symbol	Call-Up		Direct View	
Altitude Instructions	Not Provided		Not Provided	

5) Expect further clearance/expect approach clearance time estimate advisories to pilots.

Table 8-6 makes the data useage versus data presentation comparison for departures. Again, both positions will probably be using the call-up function on the TIPS and PVD displays to obtain routinely used information one or more times per operation. In addition to the data not provided by TIPS on arrivals and over-flights, the following information is not expected to be provided on departures:

1) Altitude instructions issued

2) Departure time

3) Clearance delivery status for the airports for which this function is the responsibility of the TRACON (e.g., Dobbins Air Force Base)

4) Any instructions to be issued by the tower prior to handoff of a departure to the TRACON

Paging of the individual Arrival/Overflight and Departure List Areas will seldom be required due to display capacity limi-tations. However, paging between these two basic formats is expected to be frequently required due to the balance between arrival/overflight and departure operations at the satellite positions.

8.2.7 TIPS/Departure (DR) and Handoff (DH) Positions

The duties and current flight data layouts of the two DR positions are presented in subsection 4.4.2.4. In contrast to the one to one support found at the TAR and SAT positions, both DR positions are supported by a single handoff position; and DH is only staffed on an intermittent basis during the day. This relatively low support level is due to the fact that the great bulk of the flight strips handled by the DR positions are provided by Local Control via the drop tube and few flight stips originate at the DR/DH positions during the day. The DH position is staffed when the DR positions require support in the areas of intrafacility

TABLE 8-6. DEPARTURE FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR THE SATELLITE RADAR AND HANDOFF POSITIONS

FLIGHT STATUS INFORMATION	CURRENT SAT DATA UTILIZATION		CURRENT SATH DATA UTILIZATION	
	ROUTINELY	ON OCCASION	ROUTINELY	ON OCCASION
FOR DEPARTURES				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code		Call-Up	Call-Up	
Proposed Departure Time	--	--	Call-Up	
Requested Altitude	Call-Up		Call-Up	
Departure Airport	Call-Up		Call-Up	
Route/Destination	Call-Up		Call-Up	
Departure Vector Area	Call-Up		Call-Up	
Assigned Runway	Call-Up		Call-Up	
Altitude Instructions	Not Provided		Not Provided	
Departure Time	Not Provided		Not Provided	
Clearance Delivery Status	--	--	Not Provided	
Instructions to be Issued by Tower Prior to Handoff	Not Provided		Not Provided	

coordination, En Route Center coordination, and/or making ARTS handoffs.

8.2.7.1 Example TIPS Presentation for DR-1/DR-3/DH-3

Figure 8-15 shows how TIPS would present the flight data in Figures 4-27 and 4-28, for DR-1 and DR-2 respectively, to DH-3. The display format lists departures alphanumerically by flight number under the appropriate departure airport header. The airports associated with the airport identifiers used in the headers are presented in Table 2-1. On a TIPS flight data handoff to DH-3 by either a local controller or satellite handoff controller, the transferred departures flight number would appear on the DH-3 TIPS display. DH-3 would use TIPS as required by the two DR positions to look up and modify flight data and to make flight data handoffs to other control positions.

In addition to departures, the DR positions also handle overflights and one class of arrivals to Hartsfield-Atlanta. From Table 4-3, it is seen that on the example weekday Departure Radar handled 25 arrivals and 1 overflight. As in the case for SATH, DH-3 would switch from the departure format to the arrival/overflight format by means of the ARR quick action entry. Due to the small number of these flights handled on a daily basis, switching to the arrival/overflight format should be infrequent. Since no arrivals and overflights were found in the example flight data situation portrayed in Figures 4-27 and 4-28, an example arrival/overflight format for TIPS has not been drawn for DH-3. However, if drawn, it would appear similar to the one shown for SATH-2 in Figure 8-13.

As with the other radar positions, DR will have flight data available on the plan view display on a quick look basis. To permit Atlanta to continue staffing the DH position on an intermittent basis, it is assumed that TIPS will provide the DR positions with the means to carry out the routine TIPS functions, such as flight data handoffs by means of the ARTS keyboard.

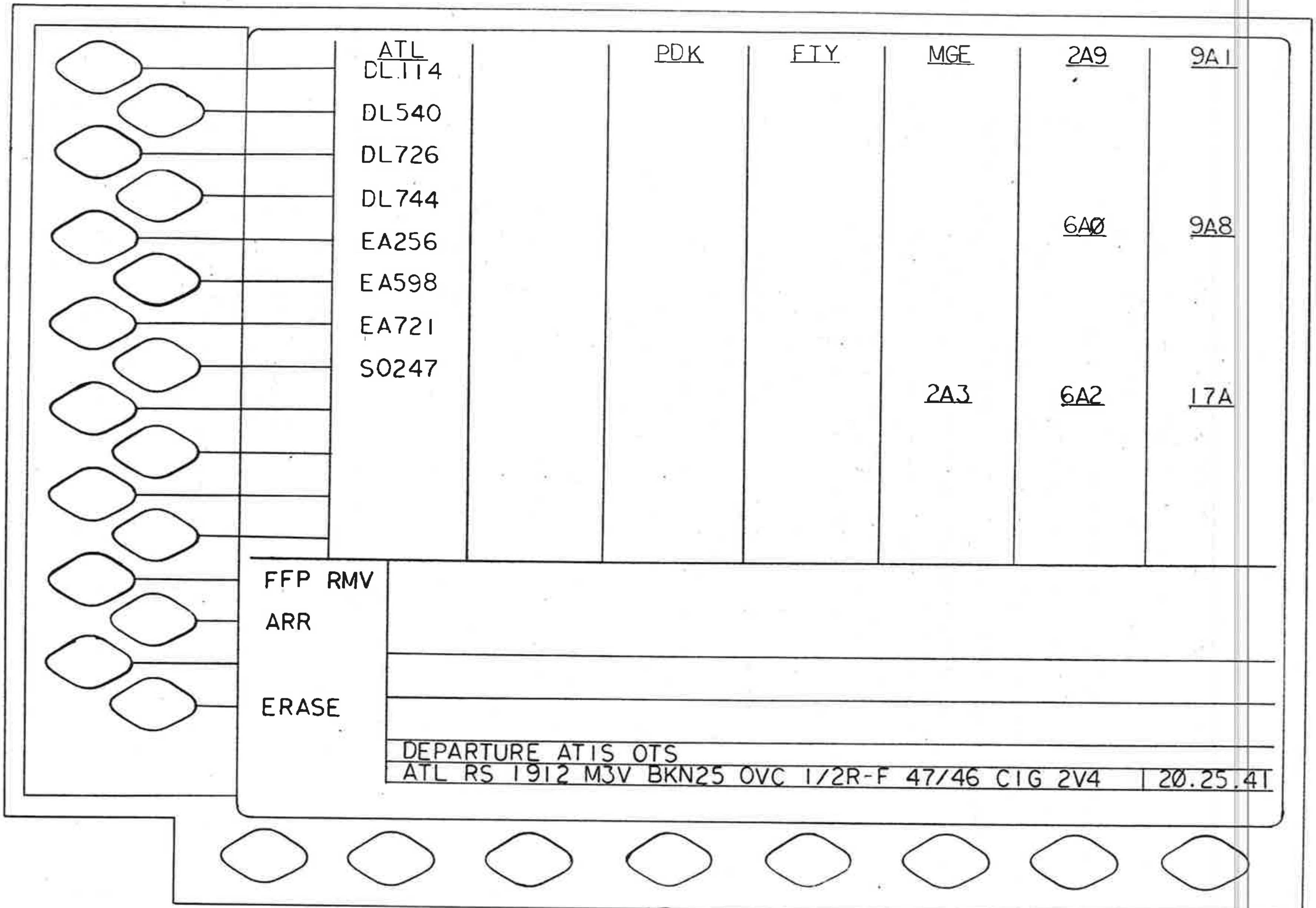


FIGURE 8-15. EXAMPLE TIPS DISPLAY PRESENTATION FOR DEPARTURE HANDOFF (DH-3) AT ATLANTA FOR DEPARTURES

8.2.7.2 DR-DH/Current Data Useage Compared to the Proposed TIPS Data Presentation

Table 8-7 compares current data useage with the TIPS data presentation for departures for both the DR and DH positions. Both positions will use the call-up function for routinely used information one or more times per operation. As with other TRACON positions, TIPS will not provide the DR/DH positions with a means to note altitude instructions as they are issued.

Table 8-8 makes the useage versus presentation comparison for the arrivals and overflights handled by DR/DH. Once again, call-up of routinely used information is expected, and TIPS will not provide a means for the controllers to note the altitude instructions as they are issued.

Paging of the List Area is expected to be required infrequently due to either capacity limitations of the List Area or the need to display flight data on the relatively few arrivals/ overflights handled by DH during the day.

TABLE 8-7. DEPARTURE FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR THE DEPARTURE RADAR AND HANDOFF POSITIONS

FLIGHT STATUS INFORMATION	CURRENT DR DATA UTILIZATION		CURRENT DH DATA UTILIZATION	
	ROUTINELY	ON OCCASION	ROUTINELY	ON OCCASION
FOR DEPARTURES				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code		Call-Up		Call-Up
Requested Altitude	Call-Up		Call-Up	
Departure Airport		Call-Up		Direct View
Route/Destination	Call-Up		Call-Up	
Departure Vector Area	Call-Up		Call-Up	
Assigned Runway	Call-Up		Call-Up	
Altitude Instructions	Not Provided		Not Provided	
Departure Time	Not Provided		Not Provided	

TABLE 8-8. ARRIVAL/OVERFLIGHT FLIGHT DATA UTILIZATION VERSUS PRESENTATION BY TIPS FOR THE DEPARTURE RADAR AND HANDOFF POSITIONS

	CURRENT DR DATA UTILIZATION		CURRENT DH DATA UTILIZATION	
FLIGHT STATUS INFORMATION	ROUTINELY	ON OCCASION	ROUTINELY	ON OCCASION
FOR ARRIVALS				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code		Call-Up		Call-Up
Coordination Fix	Call-Up		Direct View	
ETA at Coordination Fix		Call-Up		Call-Up
Altitude Instructions	Not Provided		Not Provided	
Runway Assignment	Call-Up		Call-Up	
FOR OVERFLIGHTS				
Aircraft Identification	Direct View		Direct View	
Aircraft Type	Direct View		Call-Up	
Assigned Beacon Code	Call-Up		Call-Up	
Coordination Fix	Call-Up		Direct View	
Facility to Which Flight Data Forwarded	Call-Up		Call-Up	
ETA at Coordination Fix	Call-Up		Call-Up	
Requested Altitude	Call-Up		Call-Up	
Overflight Symbol	Call-Up		Direct View	
Altitude Instructions	Not Provided		Not Provided	
Requested Route Through Terminal Area	Call-Up		Call-Up	

8.3 FINDINGS AND ISSUES

The findings of this portion of the study are summarized in Table 8-9. Eleven types of control positions in the Atlanta TRACON and Hartsfield Tower Cab were examined. Of these, 5 were radar control positions that TIPS would provide with a quick look flight data capability on their plan view displays, and 6 were positions that TIPS would provide with a new flight data display. The basic findings concerning these Atlanta positions are

1) Of the 6 positions that would receive the new TIPS display, the proposed display formats could be applied directly to the Atlanta operation at 5 of the positions - only the ground control format may require modification.

2) Today, all the flight data at a position is directly in view of the controller at all times; however, TIPS will introduce the call-up of supplemental flight status information at all 11 positions. 4 of the positions will seldom need to use the call-up function, but 7 positions are expected to use the function for routinely used data and may use the call-up function as often as one or more times per operation.

3) Today, all flight numbers of concern are directly in view of the controller at all times; however, TIPS will introduce paging of the List Area at the 6 positions that would receive the new TIPS display - 3 of the positions would seldom be required to resort to paging, but 3 positions are expected to routinely use the paging function for at least some part of the day's operation, and at 2 of the positions perhaps for the entire day.

4) TIPS, as currently envisioned, will be unable to provide the controllers with all the flight status information of concern to them, particularly operational dependent information such as runway crossing status and altitude instructions issued - it is expected that 8 of the 11

TABLE 8-9. TIPS AT ATLANTA - SUMMARY OF FINDINGS

POSITIONS AT ATLANTA	CURRENT SOURCE OF FLIGHT STATUS INFORMATION AT POSITION	TIPS SOURCE OF FLIGHT STATUS INFORMATION AT POSITION	ADEQUACY OF TIPS DISPLAY FORMAT PROPOSED FOR POSITION	EXTENT FLIGHT DATA CALL-UP EXPECTED AT POSITION	EXTENT PAGING FLIGHT DATA EXPECTED AT POSITION	EXPECTED SCRATCH PAD USEAGE	ADDITIONAL COMMENTS
Clearance Delivery (CD)	Flight Strips	TIPS Display	Adequate	For Each Operation	During Departure Peaks	None	CD No Longer Able to Flag Critical Info. For Other Controllers
Ground Control (GC)	Flight Strips, Scratch pad, ARTS BRITE Display	TIPS Display	Format Modification Recommended	Infrequently	Throughout the Day	Increased Over Today	
Local Control (LC)	Flight Strips, Scratch pad, ARTS BRITE Display	TIPS Display	Adequate	Infrequently	Infrequently	Increased Over Today	
Terminal Arrival Radar (TAR)	Flight Strips, ARTS PVD	TIPS Modified PVD	NA	For Each Operation	NA	Increased Over Today	
Arrival (Handoff (AH)	Flight Strips	TIPS Display	Adequate	For Each Operation	Infrequently	Increased Over Today	
Final Control (AR)	ARTS PVD, Scratch pad	TIPS Modified PVD	NA	Infrequently	NA	Current Scratchpad Eliminated	
Monitor (MON)	ARTS PVD, Scratch pad	TIPS Modified PVD	NA	Infrequently	NA	Current Scratch pad Eliminated	
Satellite Radar (SAT)	ARTS PVD, Flight Strips	TIPS Modified PVD	NA	For Each Operation	NA	Increased Over Today	
Satellite Handoff (SATH)	ARTS PVD, Flight Strips	TIPS Display	Adequate	For Each Operation	Throughout The Day	Increased Over Today	
Departure Radar (DR)	ARTS PVD, Flight Strips	TIPS Modified PVD	NA	For Each Operation	NA	Increased Over Today	
Departure Handoff (DH)	ARTS PVD, Flight Strips	TIPS Display	Adequate	For Each Operation	Infrequently	Increased Over Today	

positions examined will require scratch pads for this information and that overall scratch pad useage will be noticeably increased with TIPS relative to the current operation.

The general issues underlying these findings are

1) Although TIPS will greatly increase controller access to flight data on all operations within the terminal area, TIPS will display less flight data at any one time on the operations of concern to a controller than is currently the case - to what extent will flight data call up and paging be found operationally acceptable to controllers?

2) At present, the scratch pad is the controller's final solution for noting flight status information of concern that is not provided more conveniently by some other means - if scratch pad utilization is increased by TIPS as this study suggests and is not eliminated, to what extent will controllers find scratch pad note taking operationally compatible with TIPS?

It is recommended that the FAA include these two issues with the set of TIPS-controller interface issues to be addressed in the upcoming field evaluation of the TIPS engineering model.

9. INSTALLATION AND INTEGRATION

The TIPS and the CCD are being developed as two independent systems. However, they will both be installed in the major tower cabs and TRACON's, and will be used together by the controllers. This raises the question as to whether or not there is an operational requirement or advantage to integrating the two systems. This question will be examined in this section. The issue of system integration for overall system cost reduction is not treated in this report.

There are several reasons why the facility operation might require system integration. These reasons are given as follows:

1. Space limitations - There may not be adequate console space to install all the displays and controller input devices required by both systems. If the displays and/or input devices are integrated into a set of fewer equipments, this might facilitate installation.

2. Controller access - Even if there is space to install all the displays and controller input devices, the controller input devices may be quite spread out requiring the controller to move and stretch to actuate them; thus taking his attention from his primary control function and inducing fatigue.

3. Reliability - If the two systems provide similar display and controller input capabilities then integration can permit the use of the devices of one system to act as a backup to those of the other system, although in a degraded, perhaps time shared, operating mode.

To examine issues (1) and (2), we first examine the installation of the two independent systems. Following the installation study, the integration issues are discussed.

9.1 INDEPENDENT SYSTEM INSTALLATION

In studying the installation of the two systems it was assumed that at stations where TIPS displays were installed, all flight data equipment currently in place (e.g. strip trays and FDEP) could be removed, and that where CCD devices were installed, all CCD related equipments (e.g., centerfield wind indicators, approach lighting system controls, ILS monitor panel) could be removed. Therefore, this study is of the two systems as they would be in full operation, not as they might be installed for initial testing during which time both current and new equipments might be required.

The study begins with the Cab and proceeds to the TRACON. The assignment of CCD devices is given in Tables 7.7-1 and 7.7-2. The TIPS display and keyboard is assigned to all controllers in the Cab and all hand off positions in the TRACON. Radar positions in the TRACON have TIPS information provided by ARTS and use the ARTS keyboard.

9.1.1 Cab Installation

The installation begins with consideration of the LC-1 position. This position will receive a TIPS display, TIPS keyboard, CRD, SD, and LCP. This is one of each of the devices available to a Cab controller. This controller uses equipment from three adjacent bays. The bays are shown in Figures 2-44, 2-45, and 2-46. From these figures it is seen that the following list of items will be removed.

- o Windshear indicator (1 in Figure 2-44)
- o MALS controls (2 in Figure 2-44)
- o Backlight controls for wind instruments (5 in Figure 2-44)
- o Altimeter (6 in Figure 2-44)
- o Wind direction indicator (11 in Figure 2-44)
- o Wind velocity indicator (12 in Figure 2-44)
- o Clock (13 in Figure 2-44)
- o Strip delivery tubes to TRACON (14 in Figure 2-44)
- o MALS brightness settings (B in Figure 2-44)
- o Runway lighting (1 in Figure 2-45)
- o VASI panel (2 in Figure 2-46)
- o ALS panel (3 in Figure 2-46)

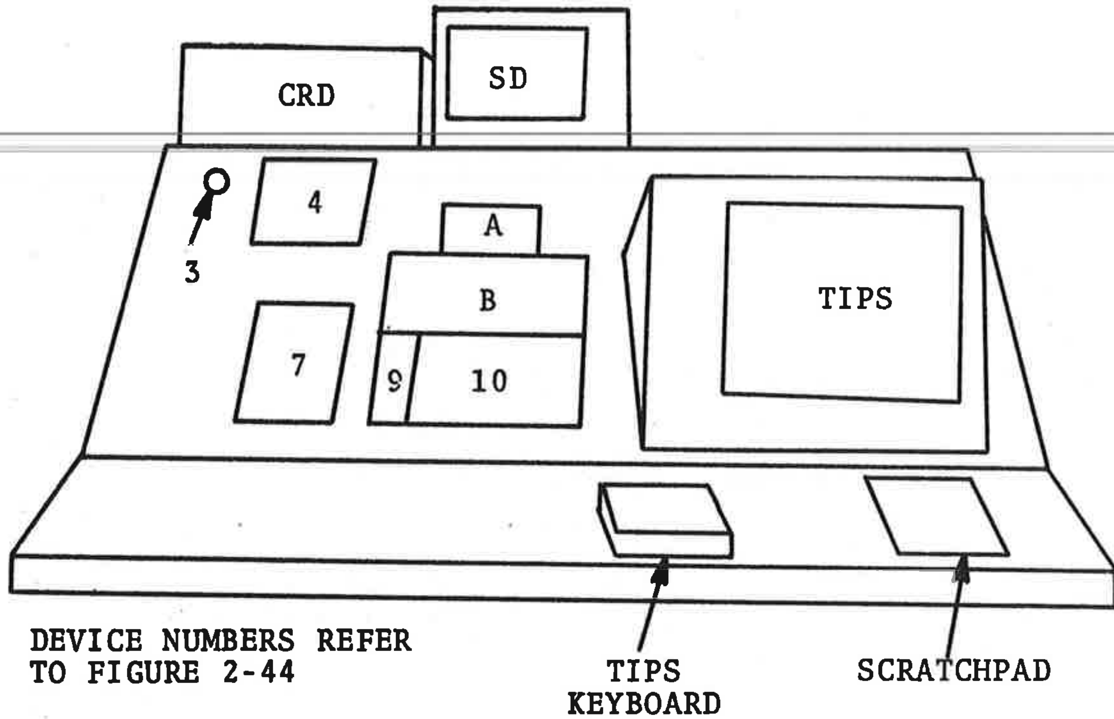
The removal of this equipment leaves a good deal of console space, yet due to the size of the TIPS display, neither the SD nor the

CRD can fit into the main bay (Figure 2-44). They must be positioned on top of the bay as the windshear indicator is now. This installation is shown in Figure 9-1. All items are shown in this figure except the LCP which would be placed where the ALS panel is now located (see Figure 2-46).

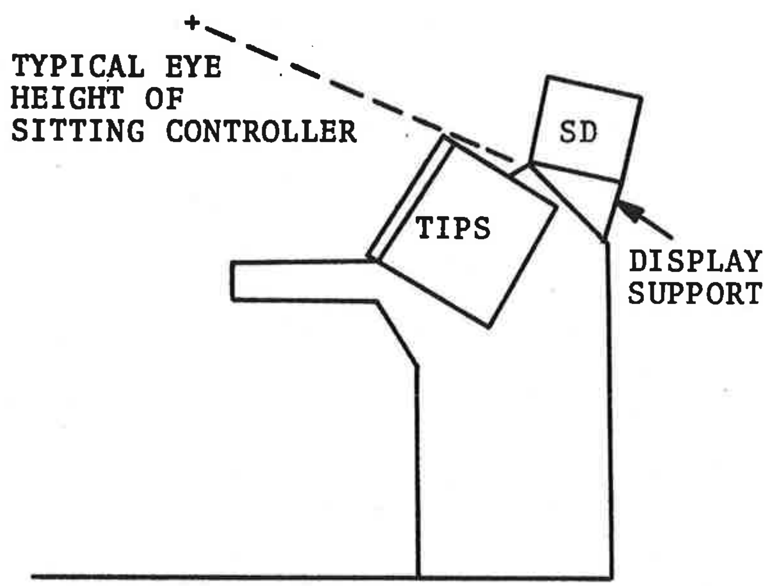
In general, the local controllers perform their jobs while seated. From Figure 9-1 it is seen that adequate line-of-sight is provided for the controller to see the SD and CRD when seated in front of the TIPS display. However, the out-of-cab view is impacted and the controller must get up from his chair and reach over the console to page the SC and acknowledge alarms on both the SD and CRD. A simple solution to the SD and CRD access problem would be a small remote keyboard containing the SD page buttons, the SD acknowledge button, and the CRD acknowledge button. This could be seated on the counter beside the TIPS keyboard greatly reducing the need for the controller to move to these displays. However, this does not affect the reduced out-of-cab view.

A possible solution to the out-of-cab viewing problem is shown in Figure 9-2. The solution relies on the TIPS display being post mounted from the floor. Good out-of-cab viewing is achieved and access to the CRD and SD is improved at the expense of some counter space. Access to the CRD and SD might be good enough to eliminate the need for the remote CCD keyboard but a good deal of reach will be required to operate the SD even as shown in Figure 9-2. The post mounted TIPS with the remote CCD keyboard will certainly be an acceptable installation. The controller will have to get up to operate the LCP, but this is his current mode of operation and while not ideal it appears to be acceptable.

Figure 9-3 depicts the placement of equipments for LC-1 and the other cab controllers. The next position treated in the study is LC-2. The main console for LC-2 is shown in Figure 2-47. In addition, LC-2 uses the runway lighting, ALS, and VASI panels from Figures 2-45 and 2-46, particularly when LC-1 is not staffed, and shares the indicators shown in Figure 2-48 with GC-3. With the installation of TIPS and CCD, the following list of equipments will

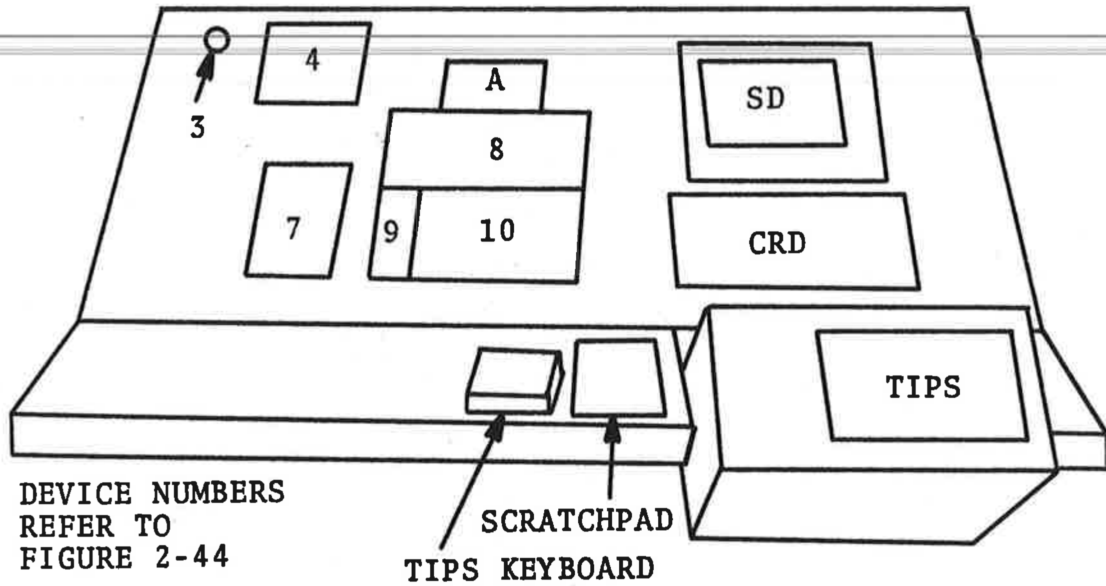


(a) FRONT VIEW

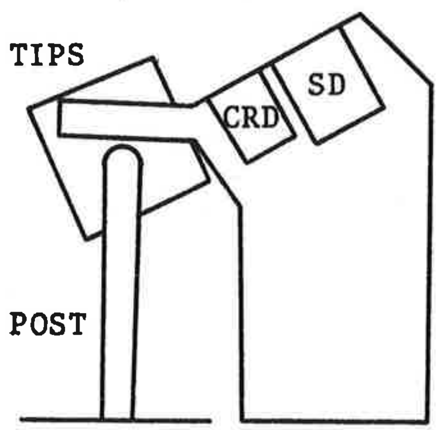


(b) PROFILE VIEW

FIGURE 9-1. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT LOCAL CONTROL POSITION (LC-1)

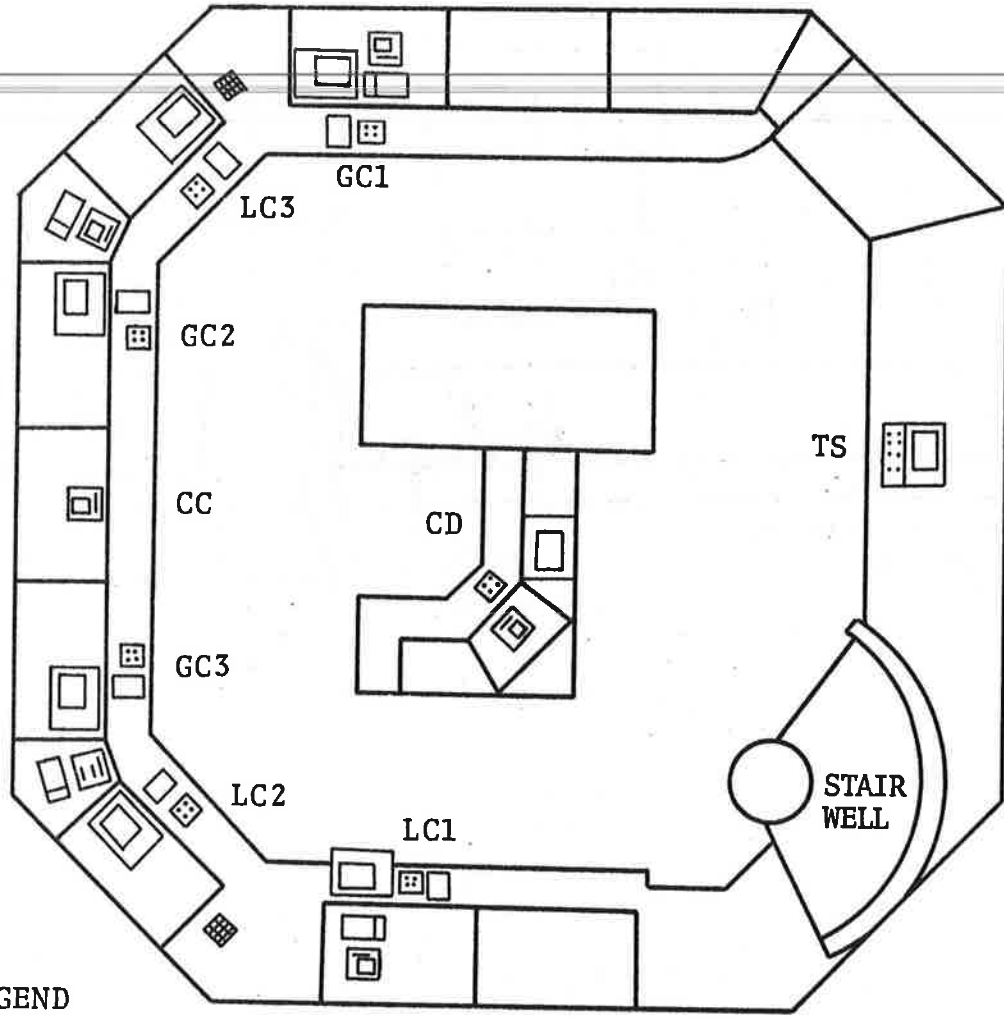


(a) FRONT VIEW



(b) PROFILE VIEW

FIGURE 9-2: ALTERNATIVE INSTALLATION OF TIPS/CCD EQUIPMENT AT LOCAL CONTROL POSITION (LC-1)



LEGEND

- TIPS DISPLAY/QUICK ENTRY DEVICE
- TIPS KEYBOARD
- SCRATCHPAD
- CCD SUPERVISORY/MAINTENANCE DISPLAY (CRD)
- CCD CRITICAL DISPLAY (CRD)
- CCD SUPPLEMENTARY DISPLAY (SD)
- CCD LIGHTING CONTROL PANEL (LCP)

FIGURE 9-3. CANDIDATE LAYOUT OF TIPS/CCD EQUIPMENT IN THE ATLANTA HARTSFIELD TOWER CAB

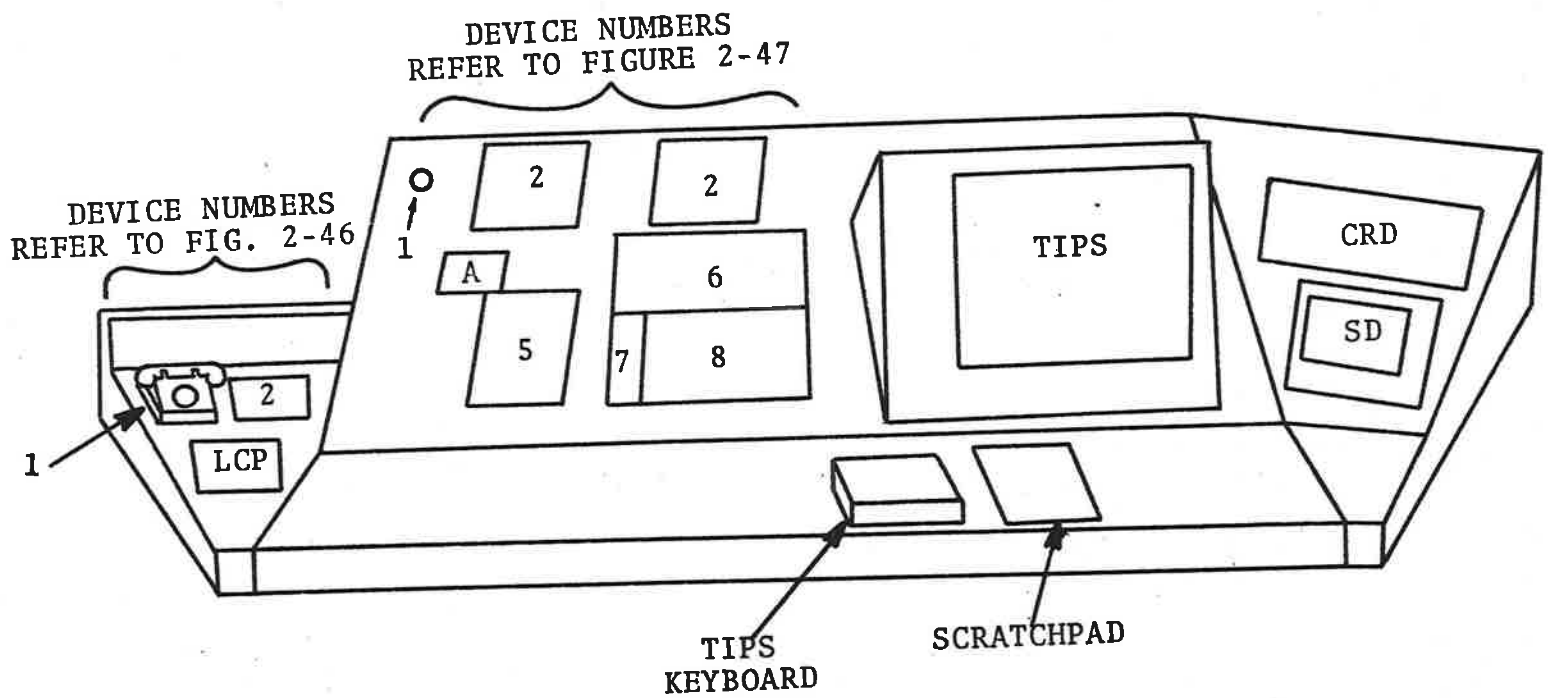


FIGURE 9-4. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT LOCAL CONTROL POSITION (LC-2)

be removed:

- o RVR display and controls (3 in Figure 2-47)
- o Strip delivery tubes to TRACON (9 in Figure 2-47)
- o Strip tray (10 in Figure 2-47)
- o Windshear indicator (1 in Figure 2-48)
- o Backlight control for wind instruments (2 in Figure 2-48)
- o Wind direction indicator (3 in Figure 2-48)
- o Wind velocity indicator (4 in Figure 2-48)
- o Altimeter (5 in Figure 2-48)
- o Clock (6 in Figure 2-48)

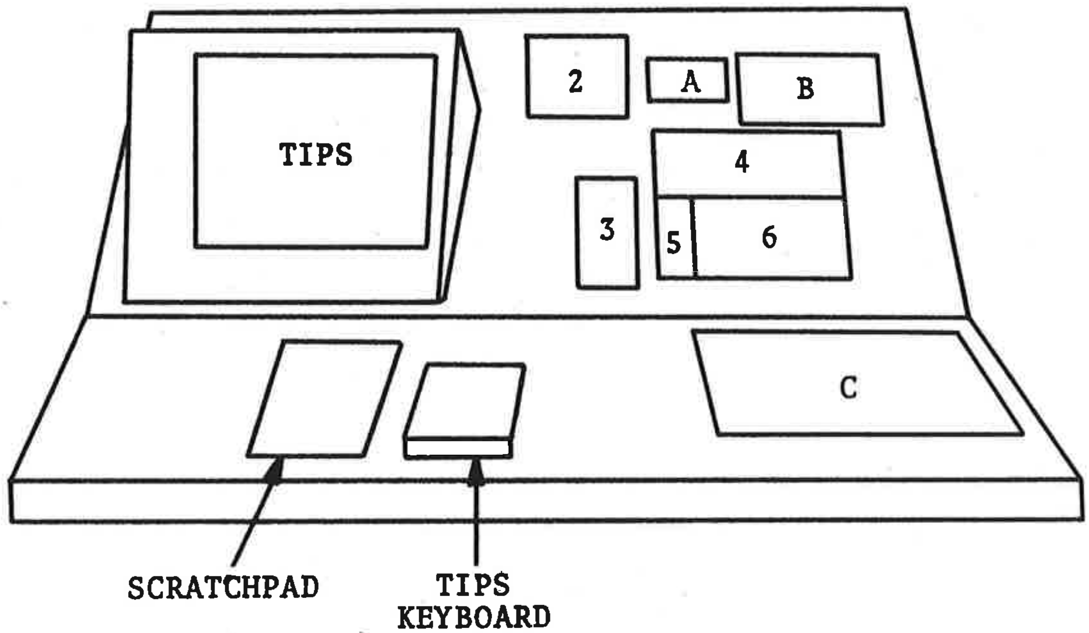
The hypothesized installation for LC-2 is shown in Figure 9-4. To accomplish this the TELCO speaker to the right must be moved left to above the FAA audio module. Again, TIPS takes up the entire main console but the two CCD displays can be installed in the corner console. There is no room in either console for the LCP so that the LC-2 might as well share the LCP already installed for LC-1. This panel is shown to the left in Figure 9-4.

The LC-2 installation is similar in controller access to that for LC-1 without the need for a post-mount of TIPS. The installation should be acceptable but a remote CCD keyboard may be required to achieve this.

The current GC-3 console is shown in Figure 2-49. In addition, he shares the indicators in the corner bay (Figure 2-48) with LC-2. The installation of TIPS and the CCD will permit the removal of the following equipment:

- o Strip bay (1 in Figure 2-49)
- o Portable strip bay (7 in Figure 2-49)

The hypothesized installation for GC-3 is shown in Figure 9-5. The ground controller does not receive a LCP and this installation assumes that he will utilize the CRD and SD of LC-2. This is similar to the sharing of the corner console displays which now takes place. These displays are easily seen by GC-3 but would require some movement if he were to acknowledge or page the displays. This movement might be acceptable since the ground



DEVICE NUMBERS REFER TO FIGURE 2-49

FIGURE 9-5. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT GROUND CONTROL POSITION (GC-3) controllers normally perform their tasks from a standing position to aid visual surveillance. If it is not acceptable, the controller can be given a remote CCD keyboard. The keyboard would operate in parallel with the LC-2 keyboard and the keys on the displays. Either of the keyboards or the keys on the displays could be used to acknowledge or page. Of course, procedures to assure both controllers recognize the alarms prior to acknowledgement would have to be worked out but permitting either controller (i.e., the least busy) to acknowledge an alarm might actually be a positive factor. However, if sharing the corner displays is not an acceptable arrangement, there is room to post-mount TIPS for GC-3 and install his own CRD and SD in the console as was done for LC-1. With one or the other option, a satisfactory installation should be possible.

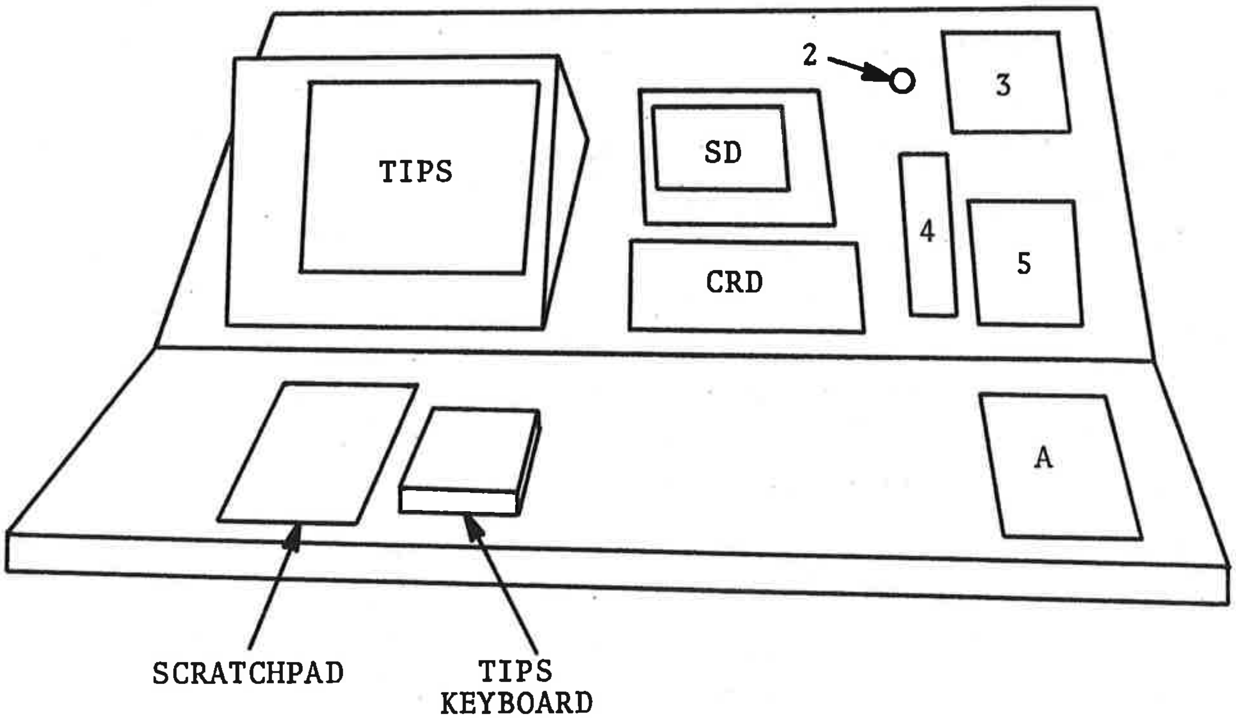
The CC position between the two ground controllers does not require TIPS and is given only an SD for use by the Team Supervisor. From Figure 2-50 it can be seen that this installation is very straightforward.

The GC-2 and LC-3 positions are nearly identical to those of GC-3 and LC-2. A similar installation of equipments as shown in Figure 9-3 should result in an acceptable installation.

The GC-1 position is shown in Figure 2-55. Installation of TIPS and the CCD will permit removal of the strip tray (1 in Figure 2-55) and the MALS brightness setting list (c in Figure 2-55). By moving the taxiway map (A in Figure 2-55) to the corner console between GC-1 and LC-3, the installation shown in Figure 9-6 is possible. This installation provides good controller access and out-of-cab view and should be quite satisfactory even without a remote CCD keyboard.

The CD position covers three bays as shown in Figures 2-59, 2-60, and 2-61. From these bays the installation of TIPS and the CCD will permit the removal of the following items:

- FDEP (Figure 2-59)
- Strip bays (1 in Figure 2-60)



DEVICE NUMBERS REFER TO
FIGURE 2-55

FIGURE 9-6. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT GROUND CONTROL POSITION (GC-1)

- o Flight strip storage bin (12 in Figure 2-61)

The hypothesized installation of the TIPS display and the SD is shown in Figure 9-7. The installation will require some swiveling of the controllers chair to address all equipments but should be satisfactory.

The Team Supervisor will manage the overall CCD system from the Supervisory/Maintenance Display (SMD). This can be installed at his desk as shown in Figure 9-3 or space will be available on the table at the end of the CD console since with the installation of TIPS the Flight Data position's use of the table is eliminated. If the table is retained by the facility this location would be preferred since the TS normally moves between the CC position and the LC-4 position (unstaffed to the right of GC-1) and the table would place the SMD closer to his normal location.

9.1.2 TRACON Installation

The TRACON installation begins with consideration of the TAR-3 and AH-3 positions. The consoles for these positions are shown in Figures 2-11 and 2-13, respectively with the AH-3 position located to the right of TAR-3. With the installation of TIPS and the CCP, the TAR-3 position will receive a TD (to be shared by the AH-3) and the AH-3 position will receive a TIPS display and keyboard. A list of equipment which can be removed is as follows:

- o RVR panels (5 in Figure 2-11)
- o Wind direction indicator (6 in Figure 2-11)
- o Wind speed indicator (7 in Figure 2-11)
- o Rheostat for wind instruments (8 in Figure 2-11)
- o Portable flight strip tray (11 in Figure 2-11)
- o Flight strip storage bin (8 in Figure 2-12)
- o FDEP printer (10 in Figure 2-12)
- o Flight strip tray (11 in Figure 2-12)
- o Flight strip holders (15 in Figure 2-12)

The hypothesized installation is shown in Figure 9-8. The TAR-3 position will receive his flight data information through the ARTS

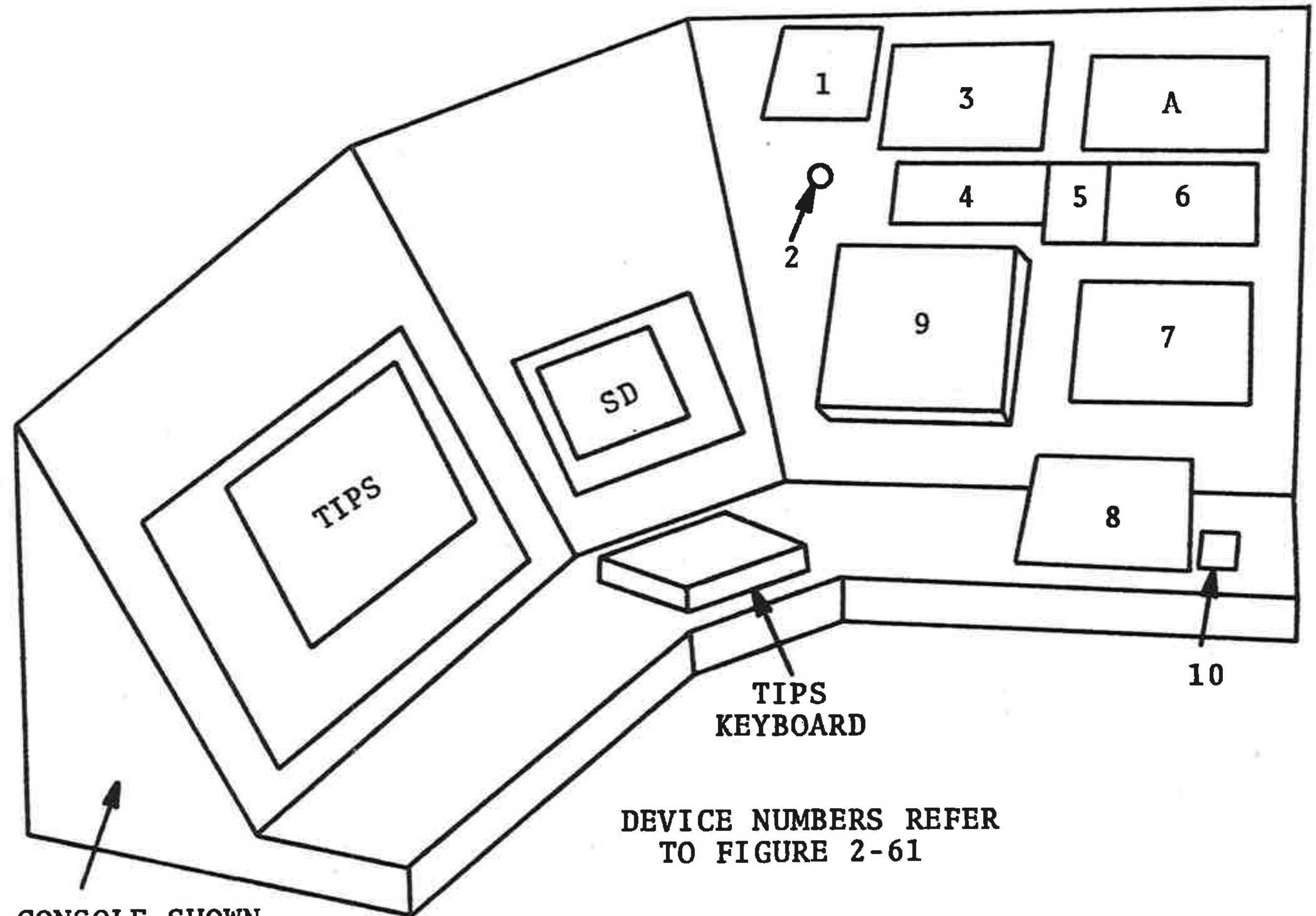


FIGURE 9-7. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT CLEARANCE DELIVERY POSITION

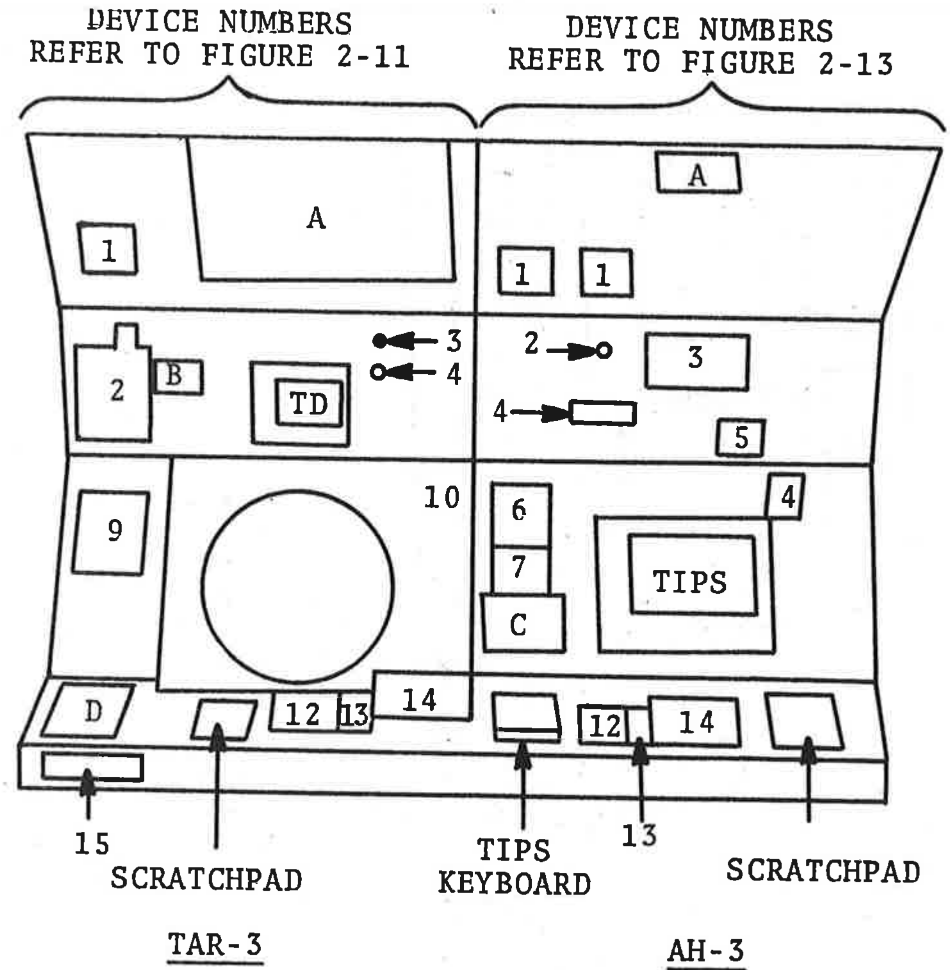


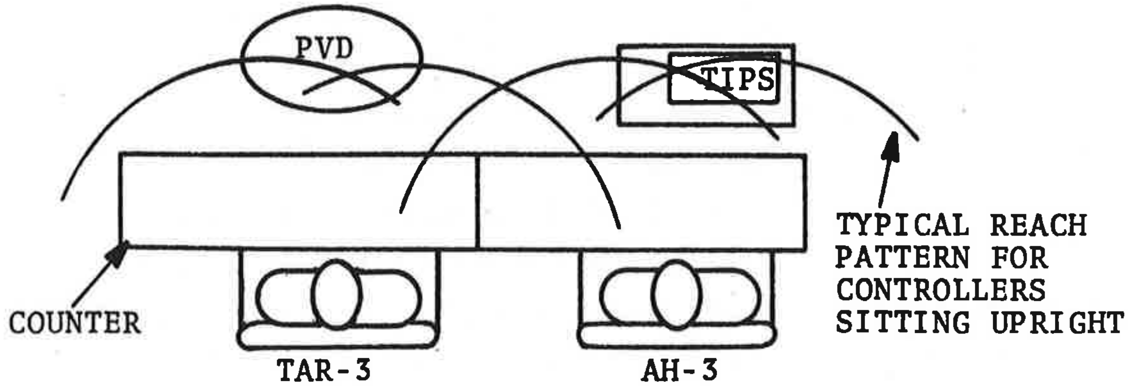
FIGURE 9-8. CANDIDATE INSTALLATION OF TIPS/CCD EQUIPMENT AT THE TERMINAL ARRIVAL RADAR/HANDOFF POSITIONS (TAR/3 AH-3)

PVD and will call up specific information by using his ARTS interface. He will receive his critical CCD related information and supplementary information via the TD located above the ARTS console. The reach to the TD requires some stretching as can be seen from Figure 9-9 in which the subject is shown touching the panel in which the TD would be installed. However, the controller will not be required to leave his chair. Access would probably be acceptable without a remote CCD keyboard. The AH-3 position will deal with the flight data on the TIPS display located directly in front of him.

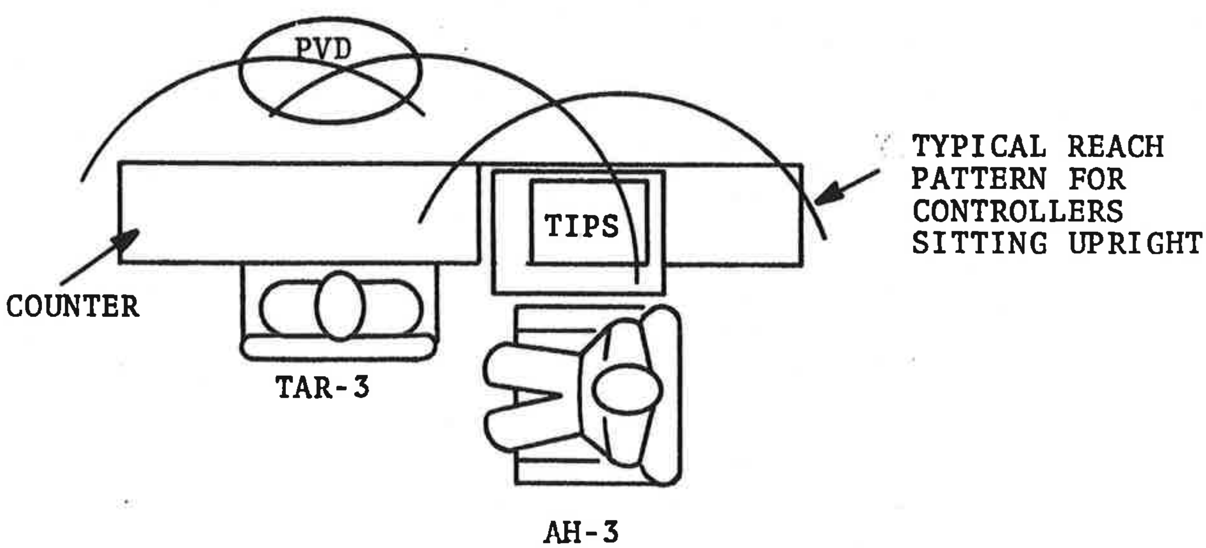
The hypothesized installation allows the two positions to visually refer to each others displays but does not allow them access to control them. With regard to the TD, the TAR-3 may desire to assign acknowledgement of alarms and paging for information to the AH-3 position. This is consistent with the philosophy that AH-3 is essentially a TAR-3 assistant to permit the radar controller to devote his full attention to the control of aircraft. To permit this a remote CCD keyboard operating in parallel with the TD buttons could be installed at the AH-3 position. Then either controller could acknowledge alarms or page the display.

A similar flexibility is desireable with regard to the TIPS display. While TAR-3 will get all of his flight data on ARTS, it will not be organized as conveniently for his use as the TIPS display. Therefore, TAR-3 can be expected to refer to the TIPS display. In so doing he may desire some actions be taken regarding the display, such as paging the aircraft list, but will be forced to rely on the handoff position to perform the action. If the AH-3 controller should be busy or absent from his position, TAR-3 would be forced to wait or move from his position. An installation permitting either controller to address the TIPS display is shown in Figure 9-10. It relies on TIPS being post-mounted from the floor and cut into the AH-3 counter. As can be seen from the figure, the post-mount provides joint access to the TIPS display where the console mount does not. It is recommended that the post-mount be considered when installing TIPS.

FIGURE 9-9. REACH REQUIRED BY CONTROLLERS TO REACH THE PROPOSED TRACON DISPLAY



a) CONSOLE MOUNTED TIPS



b) POST MOUNTED TIPS

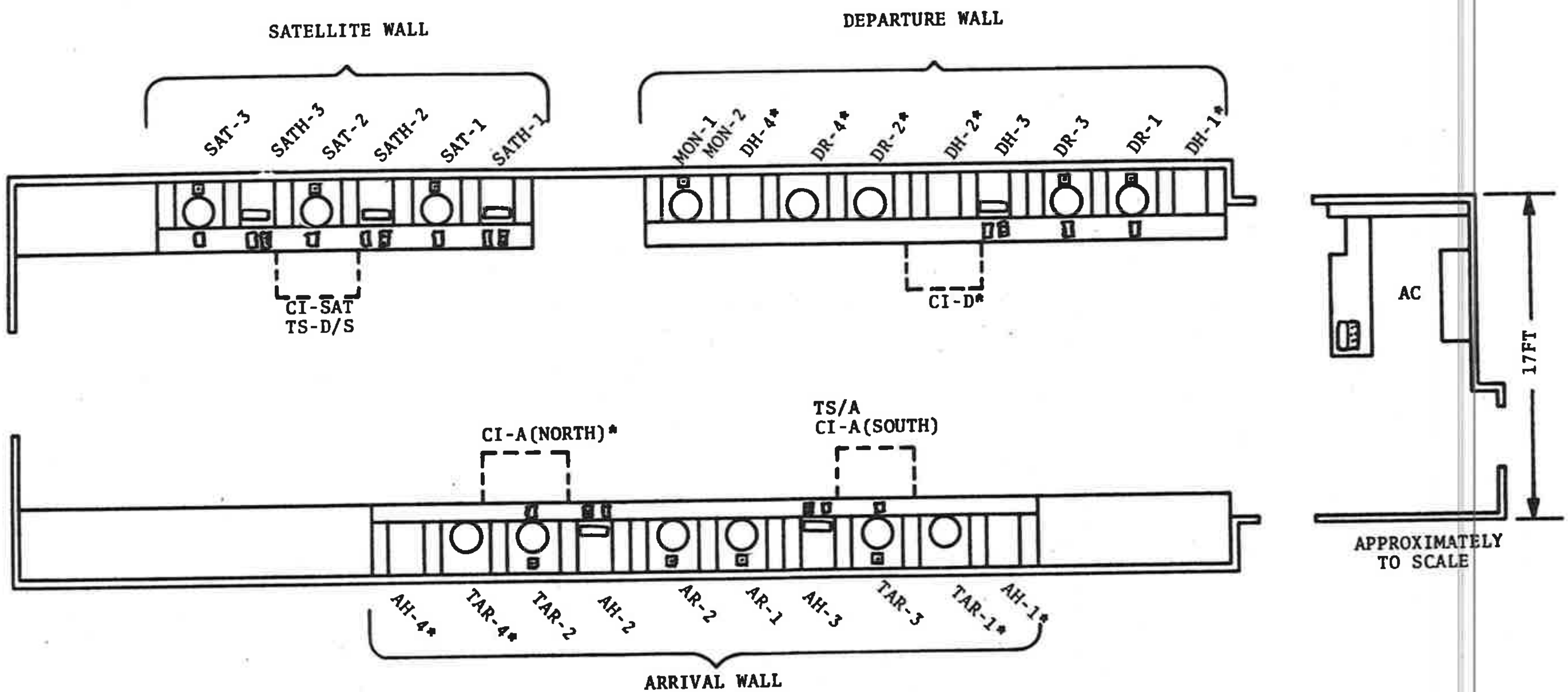
FIGURE 9-10. REACH PATTERNS OF TAR-3/AH-3 FOR TWO CANDIDATE LOCATIONS OF THE TIPS DISPLAY/QUICK ACTION ENTRY UNIT

The pairing of a radar controller and an associated handoff controller is not unusual in the Atlanta TRACON. Of the positions staffed on a daily basis this pairing occurs for TAR-3/AH-3, TAR-2/AH-2, DR-3/DH-3, SAT-1/SATH-1, SAT-2/SATH-2, and SAT-3/SATH-3. Each of these pairs were examined in this analysis and all were found to match the pattern set by TAR-3/AH-3. In each case (i) an acceptable installation could be arrived at with the TD above the ARTS console and the TIPS display mounted in the handoff position's console, (ii) the installation could be improved by furnishing the handoff position a remote CCD keyboard permitting him to address the radar position's TD in parallel with the keys on the TD, and (iii) the installation could further be improved by post mounting the TIPS display to permit access by either of the two controllers. The basic console mount is shown for each of these pairs of controllers in Figure 9-11.

Several radar controllers in the TRACON are not paired with handoff controllers. The current station for the first of these, AR-1, is shown in Figure 2-14. With the installation of TIPS and the CCD, this position receives only the TD. Flight data information will be provided solely by the ARTS PVD and accessed from the ARTS interface. From Figure 2-14 it can be seen that the following equipment will be removed:

- RVR panel (6 in Figure 2-14)
- Wind direction indicator (7 in Figure 2-14)
- Wind speed indicator (8 in Figure 2-14)
- Rheostat for wind instruments (9 in Figure 2-14)
- Digital altimeter (10 in Figure 2-14)

The hypothesized installation of the TD is shown in Figure 9-12. The installation is straight forward and should be satisfactory to the controller. This is the case with each non-paired radar control position examined which include AR-1, AR-2, DR-1, and MON-1/MON-2 the latter two being paired but on the same ARTS PVD without a handoff position. The TD installation is shown for each of the non-paired positions in Figure 9-11.



*Position not staffed on a daily basis.

CCD Supervisory/Maintenance Display (SMD)

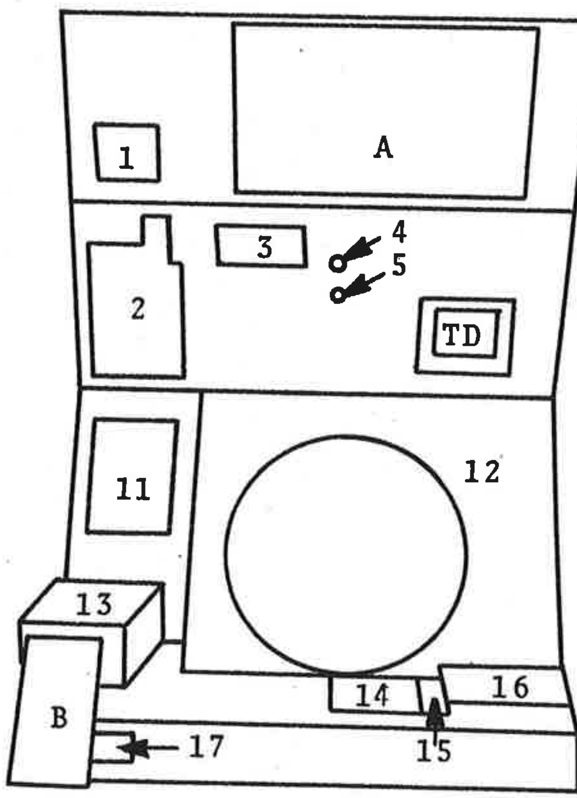
CCD Tracon Display (TD)

TIPS Display/Quick Entry Device

TIPS Keyboard

Scratchpad

FIGURE 9-11. CANDIDATE LAYOUT OF TIPS/CCD EQUIPMENT IN THE ATLANTA TRACON



DEVICE NUMBERS REFER TO FIGURE 2-14

FIGURE 9-12. CANDIDATE INSTALLATION OF TIPS/ CCD EQUIPMENT AT THE FINAL CONTROL POSITION (AR-1)

9.1.3 Installation Analysis Conclusions

The installation analysis demonstrates that the two systems can be successfully installed with good viewing and access by the controllers. However, to assure satisfactory performance, the following considerations should be given. (1) The capability to add remote CCD keyboards should be provided to the CCD system. The keyboards would interface with the SD and the CRD in the Cab, and the TD in the TRACON permitting the users to acknowledge alarms and page for supplementary information in parallel with the keys on the CCD units and other keyboards. (2) The installation of the TIPS display between a radar controller and the associated handoff position in the TRACON should be investigated. The installation would be via a post-mount from the floor. If acceptable this would provide added flexibility in the use of the unit by both controllers.

9.2 INTEGRATION DISCUSSION

The installation analysis indicates that it is quite probable that the two independent systems can be successfully installed with acceptable performance without integration. Console space is available and controller access will be acceptable. However, the TIPS and CCD do provide similar display and controller input capabilities. If the CCD functions could be performed by the TIPS devices then (i) if the CCD devices were retained, TIPS could provide a backup to the CCD devices thus improving overall system reliability (see integration issue 3) or, (ii) if the CCD devices were omitted, TIPS could provide nearly all the information and input capability needed by the controller with just two devices, improving controller access and reducing system cost (although at the expense of overall system reliability). For these reasons the potential for providing the CCD functions via the TIPS controller devices was examined.

9.2.1 Controller Device Consolidation

The first consolidation examined is the TRACON Display (TD) into TIPS. If the decision is made to post mount the TIPS display between the radar controller and the associated handoff position then a TIPS display will be readily available to TAR-2, TAR-3, DR-3, SAT-1, SAT-2, and SAT-3 (see Figure 9-11). For the other radar positions (AR-1, AR-2, DR-1, MON-1 and MON-2), consolidation of the TD into TIPS is not possible and a TD will be required as indicated in Figure 9-11.

To consolidate the TD into TIPS the following changes would be required:

(1) The four critical (fixed) lines of the TD would be placed on the two lines of TIPS now assigned to weather and status. Each of the four critical lines now have 32 characters available. Each of the two TIPS lines have 68 characters if extended to the left as shown in Figure 9-13. This provides ample space for the four critical lines and, in fact, gives two additional spaces per runway associated line to help space out the RVR readings.

(2) The TIPS keyboard and preview area would be used to enter RVR alarm settings.

(3) The column-one button when struck alone without first striking a row button would be used as an alarm acknowledge button. It is so labeled in Figure 9-13. An audible alarm would be added to the TIPS display.

(4) The information on the Critical Display Weather Page (see Figure 7.5-2) will be displayed in the readout area except when that area is in use for acquiring flight plan information. When an alarm for that page occurs and flight plan information is in the readout area, the readout page code (e.g., RO) will be displayed in the last two characters on the time-altimeter setting-etc.-line as is the case for alarms on the other pages. The information from Figure 7.5-2 is shown in the readout area in Figure 9-13. Only two of the four 59 character lines are required.

(5) The column-two button when struck alone without first striking a row button would be used to display the pages for selection down the left hand column of the display as shown in Figure 9-13. Both a number and alphabetic abbreviation would be

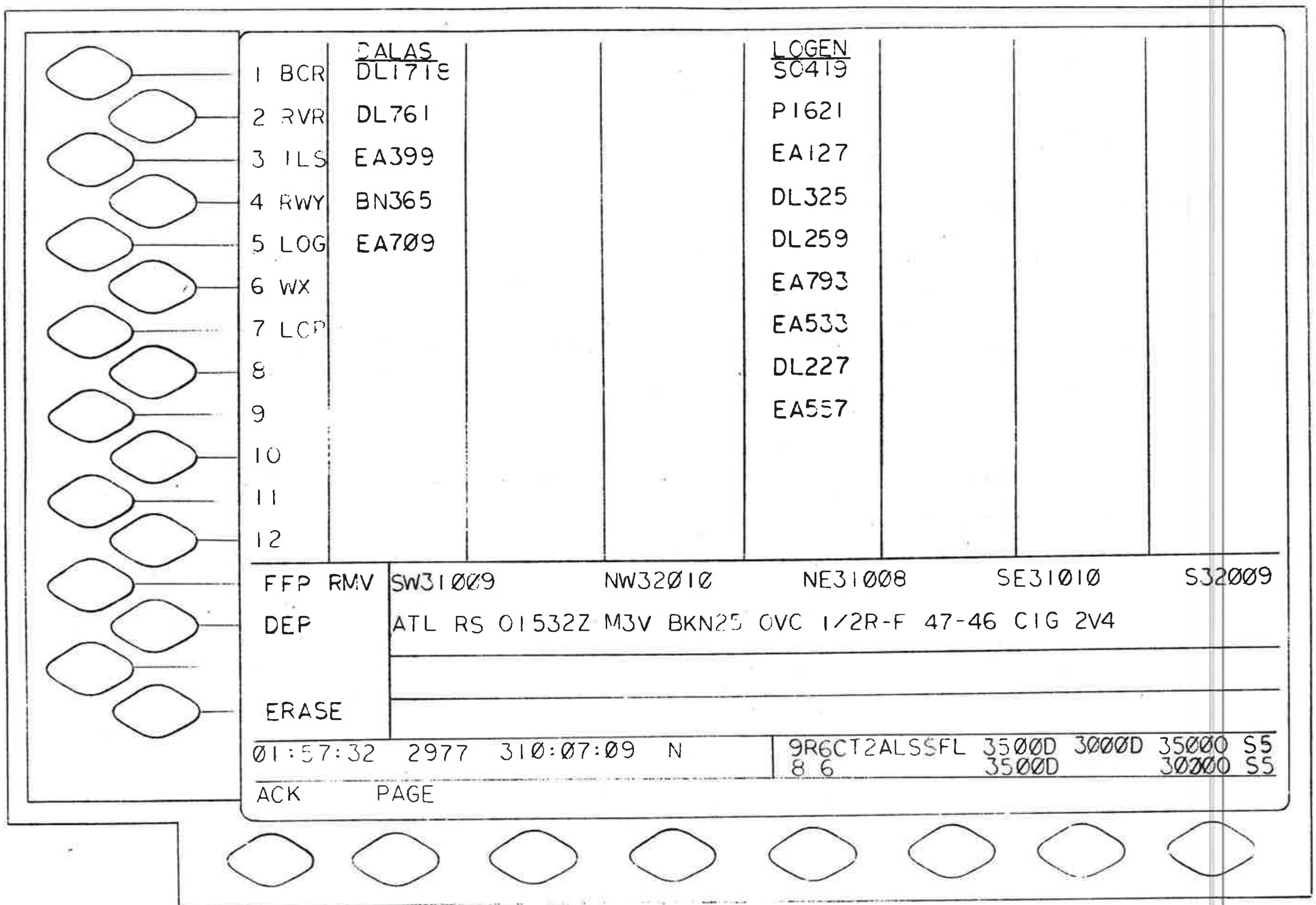


FIGURE 9-13. CRITICAL CCD INFORMATION DISPLAYED ON TIPS

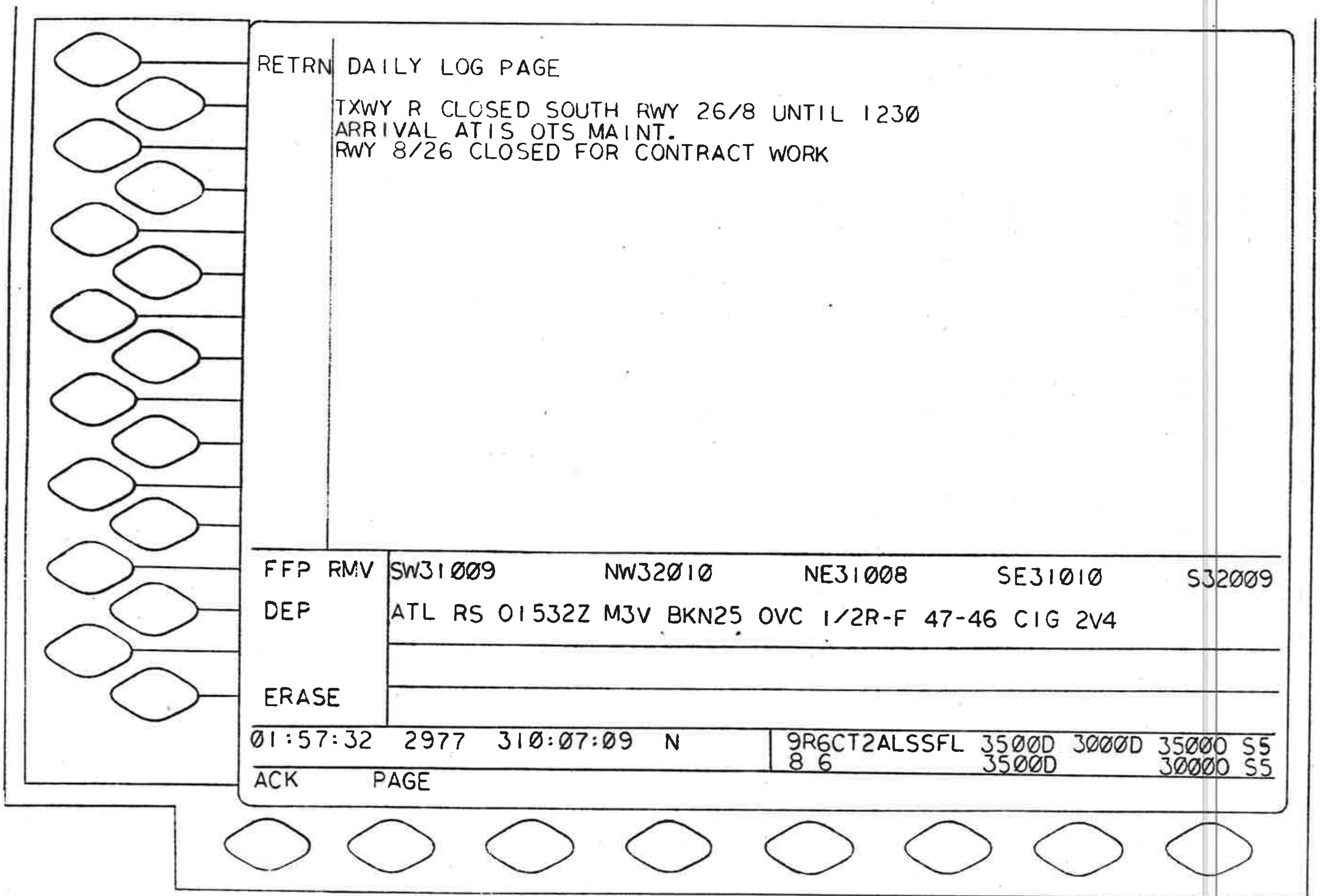


FIGURE 9-14. SUPPLEMENTAL CCD INFORMATION DISPLAYED ON TIPS

possible. Striking the page button would delete the TIPS flight plan information making the upper portion of the page available for text, except the top button in the column of buttons on the left would be a "RETURN" button. When on a CCD page, striking the RETURN button would return the system to the TIPS mode. An example is given in Figure 9-14.

There are few apparent problems with the consolidation of the TRACON Display into TIPS. The radar position always has the flight data information available via ARTS since he pages away from the flight data information on the handoff position TIPS display. The radar controller can acknowledge alarms and look up information himself or ask the associated handoff position to do this for him. The potential problems with this system are:

(1) The ease of reading the ctirical information is poorer than that of the TD. The characters are smaller and the lines are spaced much closer together. In addition, the three runway related lines do not all line up over one another, one being below the time-altimeter setting-etc.-line.

(2) The two-button actions are required to select a page rather than just one as for the TD.

However, these problems do not appear very serious and some slight TIPS reformatting (e.g., to space the critical information lines further apart) might eliminate them.

The next consolidation examined is the use of the TIPS as just described for the TRACON in the Cab to replace the critical display and the supplementary display. The problems here appear more serious than those in the TRACON. The problems are:

(1) The legibility of the critical information is much poorer than that of the CRD. Controllers move about the Cab to acquire visual surveillance information (e.g., coverage of the ramps and close-in taxiways) and this sets a requirement of reading the critical information from a distance. This is why the CRD characters are as large as they are with large inter-line spacing.

(2) The TIPS display does not always present all of the information on the CRD as required. The information on the Critical Display Weather Page is shared with the flight plan data in the readout area.

(3) While calling up a SD page on TIPS the controller must give up his flight data information. Unlike the radar controller in the TRACON with ARTS, the Cab controller has only his TIPS for flight plan data. The controller may require his flight data always be available at a glance, without a call up action.

These problems may not be easily solved by TIPS. Reformatting TIPS to put all critical information in a dedicated area of the display and large enough to be read at a distance will reduce the space available for flight data increasing the need for paging. The operational acceptance of paging flight data and away from flight data to acquire supplementary data is key to the success of this consolidation.

The last consolidation examined is the Lighting Control Panel into TIPS. It appears possible to use the quick action entry buttons of TIPS to perform equipment control actions. To accomplish this the following changes would be required:

(1) The LCP would be assigned a page for call up via the twelve page menu.

(2) The LCP page would be formatted as shown in Figure 9-15. To reset the level on the ALS for runway 9R the controller would (i) push the "PAGE" button bringing up the menu as shown in Figure 9-13, (ii) push the "LCP" button bringing up the page shown in Figure 9-15, (iii) push buttons 1 then 2 shown in Figure 9-15 to identify the ALS for runway 9R, (iv) push button 3 in Figure 9-15 to enter level 3 into the 9R ALS and (v) push the return button to restore the flight data information.

The problem with this consolidation is the number of buttons which have to be pushed to accomplish a simple transaction as illustrated above. In the study of a similar paged control panel concept at Boston Logan Airport (Reference 9-1) controllers were

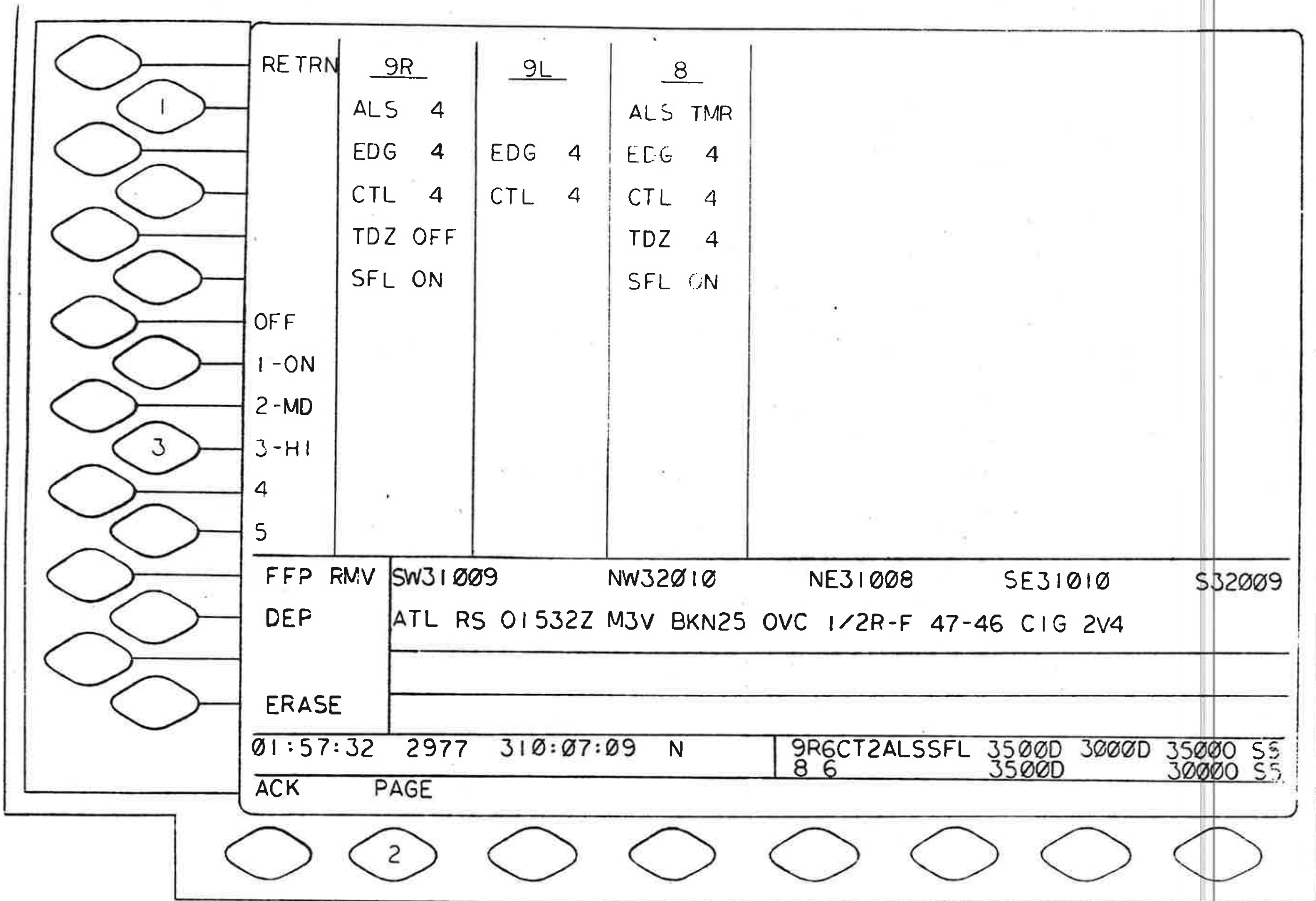


FIGURE 9-15. LIGHTING CONTROL PANEL CONSOLIDATED WITH TIPS

unwilling to page to the lighting control panel and desired that page be continuously displayed. For the Boston control panel concept two buttons would be pushed just as is the case with the LCP. This was acceptable to the controller. This is versus six buttons which would be pushed with the TIPS control concept. This number of actions would likely be unacceptable. During low IFR night operations the controller can be asked by the pilots of approaching aircraft to adjust approach light levels twice. The pilot desires the lights bright until he breaks out at which point he wants them turned down. They can be quite blinding. This service would take a good deal of the controllers time with the TIPS control concept and introduce a delay in the controllers response once the lower light level is requested. The separate LCP would appear much preferrable.

9.2.2 Integration Conclusions

The following conclusions are drawn from the installation/integration analysis:

(1) It is quite probable that the two independent systems can be successfully installed with acceptable performance without integration. Console space is available and controller access will be acceptable.

(2) To improve the operational utilization of the CRD, SD and TD, these units should be capable of accepting in parallel, separate remote keyboards. The keyboards would permit each keyboard holder to page the display and acknowledge alarms.

(3) If the facility decides to post-mount TIPS between radar and handoff controllers in the TRACON, then consolidation of the TD into TIPS appears feasible. However, if there is a separate TD keyboard capability (item 2 above), then while the consolidation may save money, it does not improve the controllers access to the CCD related information. The information is no more visible and the often used buttons are no more conveniently located. In either case, the radar controller has the option of acknowledging and paging the display himself or asking the handoff position to do it.

While controller access is not improved, this consolidation would permit the use of TIPS if the TD failed. However, the TD will be small and lightweight and hopefully a plug in unit for which spares will be available. Replacement should be possible in minutes and TIPS/CCD integration to provide a backup for those few minutes would not likely be cost effective.

(4)Consolidation of the CRD and SD into the TIPS display in the Cab encounters problems not encountered in the TRACON. Unlike the radar controller in the TRACON who has ARTS, the Cab controller has only his TIPS display for flight plan data. Paging away from the flight plan data (and paging flight plan data itself) may be objectionable to the controller who may desire his flight plan data available at a glance as it is today.

If the paging is found not to be operationally objectionable, then this consolidation would appear feasible. However, as with the TD consolidation, controller access would not be appreciably improved and integration to provide a backup capability for the few minutes it would take to replace the SD would probably not be cost justified.

(5) Consolidation of the LCP into TIPS does not appear feasible. The concept would require excessive button pushing to accomplish simple actions which can be required with high frequency, particularly during low IFR conditions at night.

REFERENCES

9-1 Preliminary Consolidated Display Designs; Bishop, Gregory, et al.; March 1979, U.S. Dept. of Transportation, Federal Aviation Administration, FAA-RD-79-24.

APPENDIX A

MANUAL FLIGHT STRIP MARKINGS

To document the more common flight strip markings made by the Atlanta controllers, a full day of flight strips was surveyed for representative examples. The meaning, purpose, and usefulness of these markings were then discussed with an Atlanta controller. The results of that survey and discussion are presented in this appendix.

There are 3 types of operations handled by Atlanta controllers arrivals, departures, and overflights. The data on the corresponding 3 types of flight strips are presented as follows:

- o Arrivals to Hartsfield-Atlanta or satellite airports
  - o Example flight strips, Figure A-1
  - o Manual markings found, Table A-1
- o Departures from Hartsfield-Atlanta or satellite airports
  - o Example flight strips, Figure A-2
  - o Manual markings found, Table A-2
- o Overflights
  - o Example flight strips, Figure A-3
  - o Manual markings found, Table A-3

The survey shows that these handwritten notations can be extensive - six or more per flight strip are common. The purposes of these notations are varied and include:

- o Noting changes to the typewritten flight data (e.g., destination airport changed, Table A-1)
- o Emphasizing information critical to the handling of the flight even though it already is typed on the flight strip (e.g., the coordination fixes are emphasized on arrival flight strips, Table A-1)
- o Noting critical information to be used in the handling of

the flight (e.g., the type of approach to be made to a satellite airport, Table A-1)

- Noting that a particular instruction has been issued to the pilot (e.g., altitude instructions, Table A-1)
- Noting that required inter-controller coordination has taken place (e.g., a notation is made when approach information is passed from the TRACON to the control tower of a flight's destination satellite airport)
- Noting information for other than controller purposes such as for traffic counting or incident reconstruction (e.g., a T marked on Tower En Route Controlled flights)

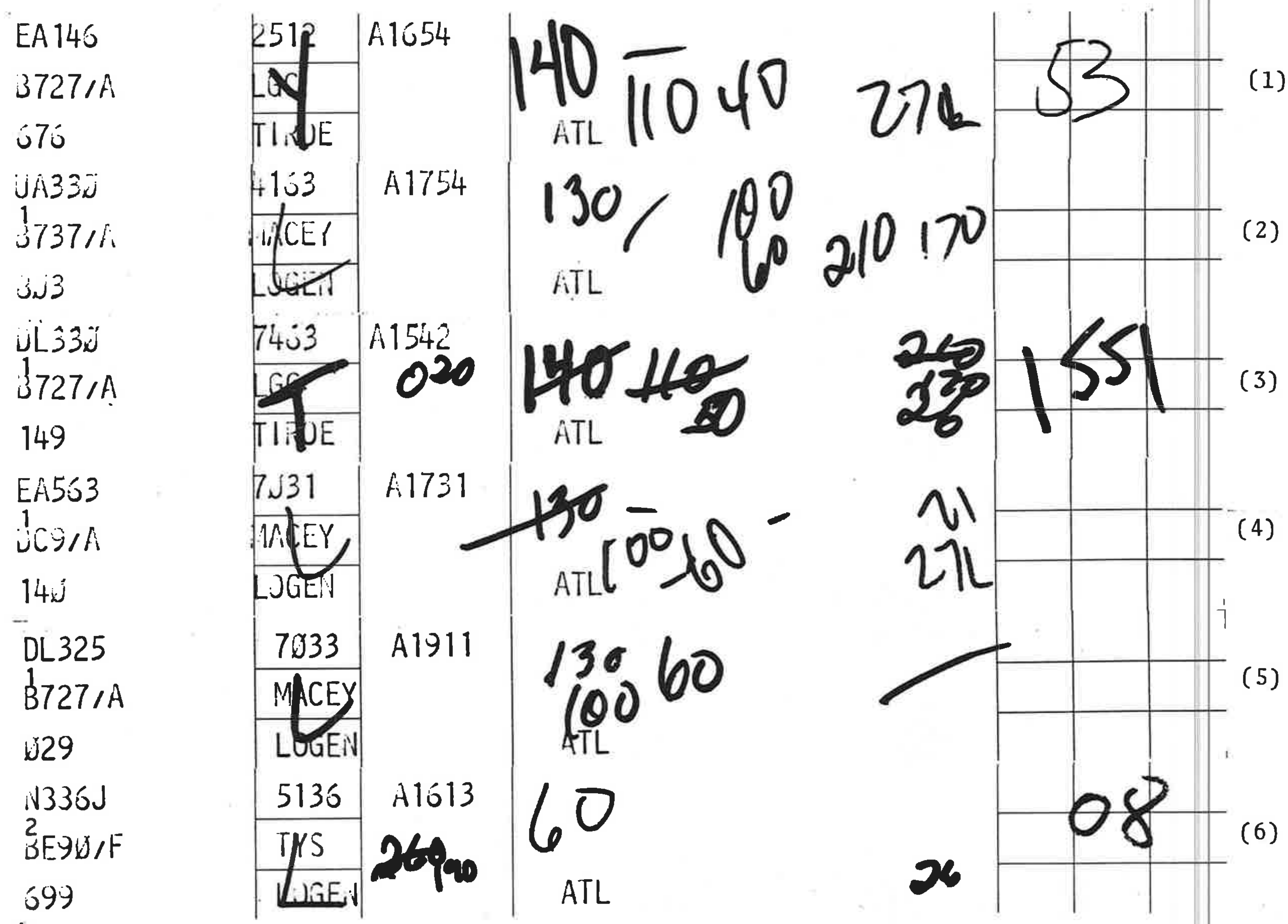


FIGURE A-1. ARRIVAL FLIGHT STRIP EXAMPLES

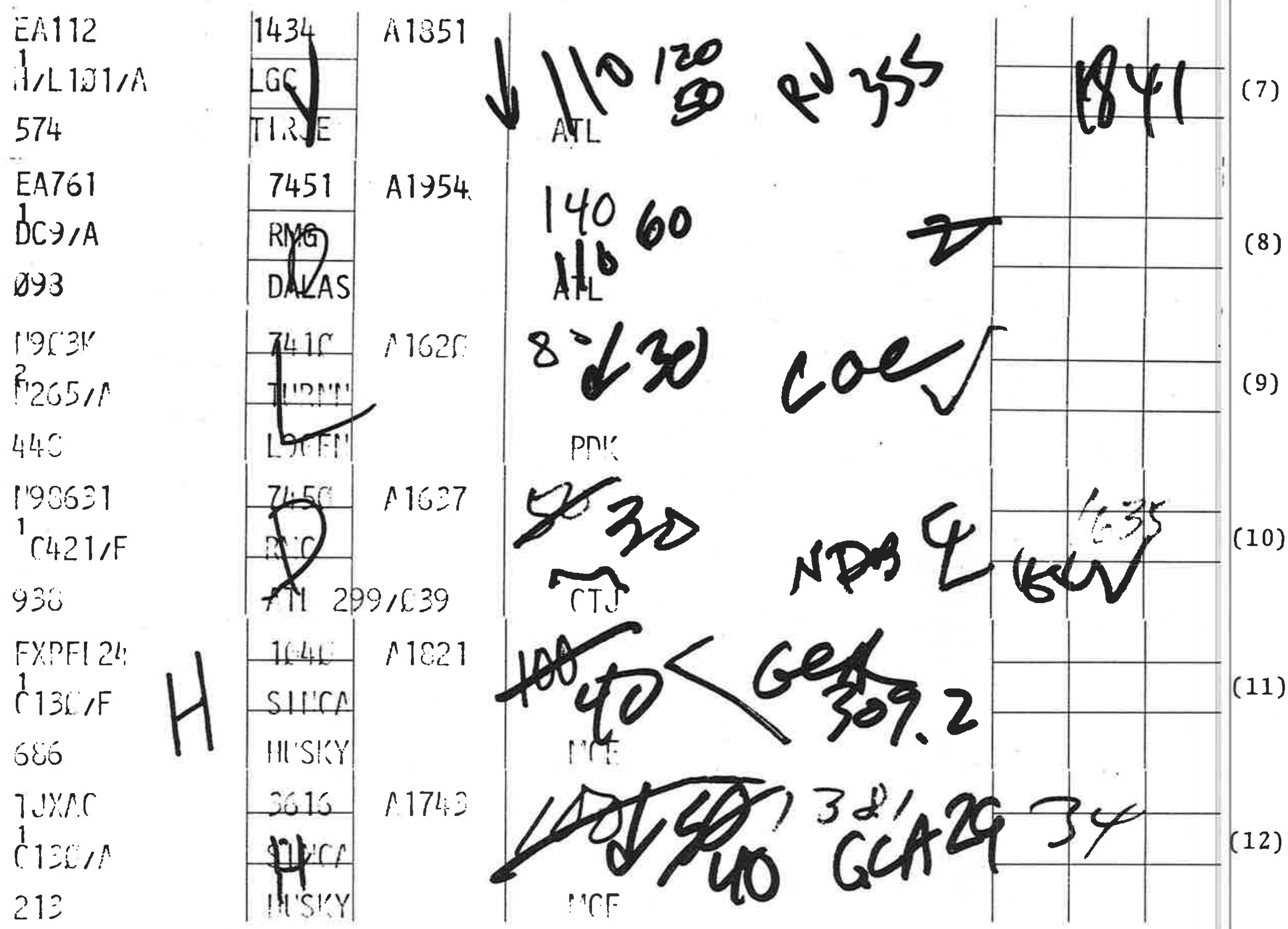


FIGURE A-1. ARRIVAL FLIGHT STRIP EXAMPLES (CONT'D)

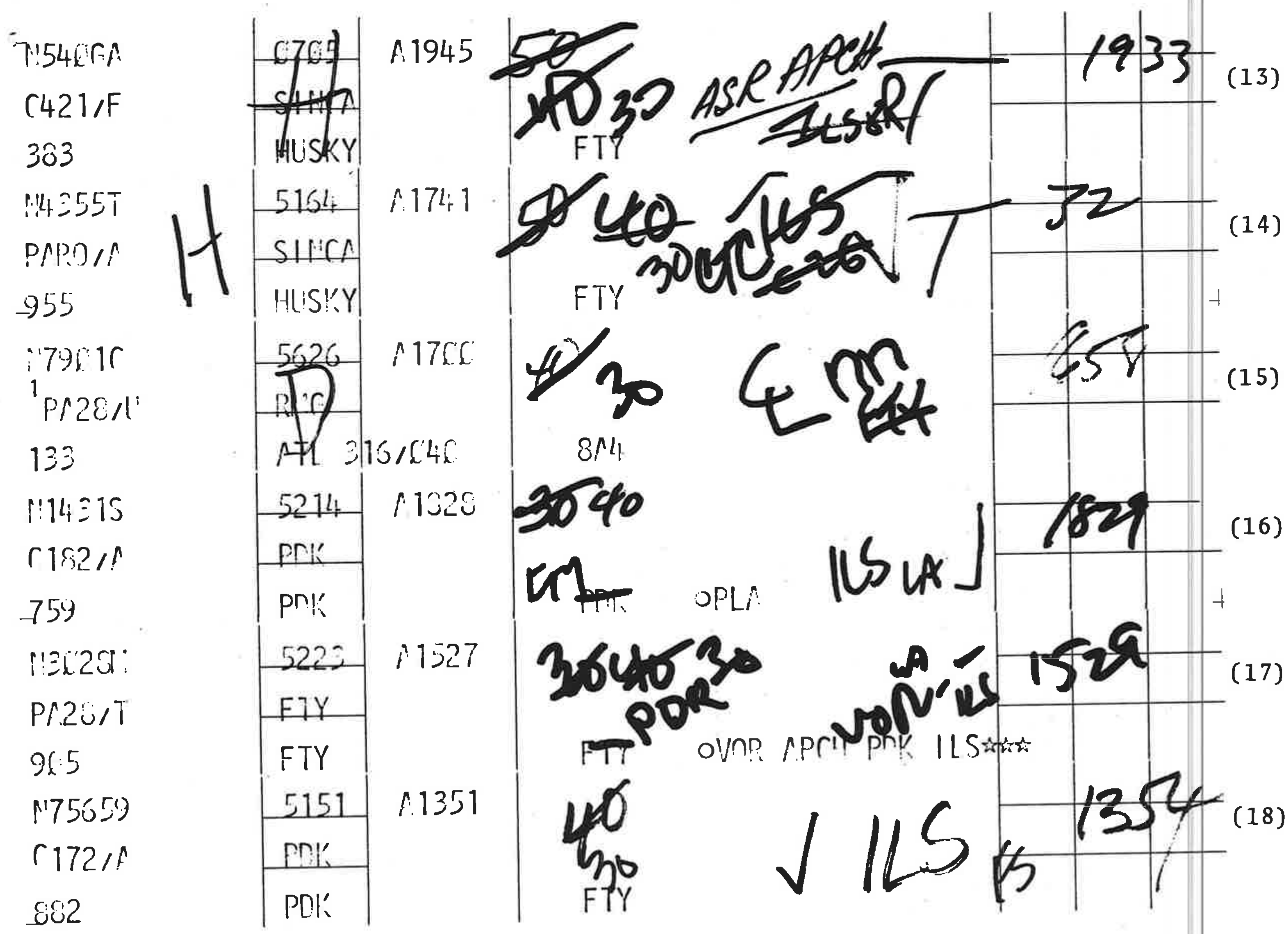


FIGURE A-1. ARRIVAL FLIGHT STRIP EXAMPLES (CONT'D)

TABLE A-1. SAMPLE OF MANUAL NOTATIONS MADE ON ARRIVAL FLIGHT STRIPS

STRIP LOCATION (FIG. 4-8)	MANUAL NOTATIONS	EXAMPLE FLIGHT STRIP (FIG. A-1)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACES 6&7	Y	1	TIROE Coordination Fix	To Emphasize The Coordination Fixes For Quick Controller Reference of The Flight Strips In The Trays	AH for Atlanta Arrivals SATH For Satellite Airport Arrivals	Routinely
	L	2	LOGEN Coordination Fix			
	T	3	TIROE Coordination Fix			
	D	8	DALAS Coordination Fix			
	H	12	HUSKY Coordination Fix			
SPACE 8A	020 ~~260~~ 190	3 6	Heading Instructions	Reminder That Instruction Issued	TAR	Controller Dependent And Uncommon
SPACE 9	140 100 60 86 30	1 9	Altitude Instructions In Hundreds of Feet	Reminder That Instruction Issued	TAR For ATL Arr. SAT For SAT Arr.	Routinely
SPACE 9A	CTY	10	Destination Airport West Georgia Regional	To emphasize Uncommon Dest. Airport For Quick Controller Reference - Common Satellite Airports FTY, PDK, MGE	SATH or SAT	Routinely
	FTY ~~PDK~~	16	Destination Airport Changed	To Note The Change To The Filed Flight Plan	SATH or SAT	Routinely
SPACE 9B	210 170 21	2 4	Aircraft Speed Instructions (210 & 170 kts)	Reminder That Instruction Issued	TAR	Controller Dependent But Common
	27L	1	Runway Assignment	To Emphasize Unexpected Runway Assignment - North Coord. Fix Arrivals Landing On South Runway or South Arrivals Landing On North Runway	TAR	Routinely
	RV355	7	Heading Instruction - VOR Radial Vector 355 Deg.	Reminder That Instruction Issued	TAR For ATL Arr. SAT For SAT. Arr.	Controller Dependent And Uncommon
	LOC	9	Localizer Approach	Reminder Of The Type Of Approach To Be Made To Runway Of A Satellite Airport	SATH or SAT	Routinely
	NDB	10	Non Directional Beacon Approach			
	138.1 GCA	12	Ground Control App. On Freq. 138.1			
	ASR APCH	13	Vector Approach To Runway			
	CTC	14	Visual Ground Reference App.			
	ILS - C26	14	ILS-Circle App. To Runway 26			
	ILS - LA	16	ILS-Low Approach (No Landing)			
	VOR	17	VOR Approach			
	ILS - FS	18	ILS-Full Stop Landing (e.g., A Touch and Go Landing)			

TABLE A-1. SAMPLE OF MANUAL NOTATIONS MADE ON ARRIVAL FLIGHT STRIPS (CONT'D)

STRIP LOCATION (FIG. 4-8)	MANUAL NOTATIONS	EXAMPLE FLIGHT STRIP (FIG. A-1)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACE 9B (CONTINUED)	CL 1717	15	Cancel IFR Clearance And The Time	To Note Termination Of The Filed Flight Plan	TAR For ATL Arr. SAT For Sat. Arr.	Routinely
	✓	5	Final Approach Speed Issued To An Atlanta Arrival	Reminder Of The Completed Action	TAR	Controller Dependent And Uncommon
	✓	16	Approach Information Relayed To the Satellite Control Tower	Reminder Of The Completed Action	SATH or SAT	Routinely
SPACE 9C	T	14	Tower En Route Controlled Flight	To Emphasize The Type Of Flight Primarily For Traffic Counting Purposes	AH For ATL Arr. SATH For Satellite Airport Arr.	Routinely Marked But Not Needed By Controllers To Control Traffic
SPACE 10	34	No Examples	Number of Minutes Arrival Spent In Stack At Outer Fix	?	TAR For ATL Arr. SAT For Sat. Arr.	Stacking Rarely Done In Terminal Area - Done More By SAT Than TAR
SPACE 12	53 1551	1 3	Time Of The ARTS Handoff Of The Arrival From The En Route Center To The TRACON	Of No Real Use Today - A Hold-over From The Non-Radar Approach Control Days	AH For ATL Arr. SATH For Satellite Airport Arr.	Controller Dependent But Common
SPACE 15	42	No Examples	Time Arrival Expected To Leave Stack	Estimated Time Given Pilot For His Planning Purposes And Recorded	TAR For ATL Arr. SAT For Satellite Airport Arr.	Stacking Rarely Done In Terminal Area - Done More By SAT Than TAR

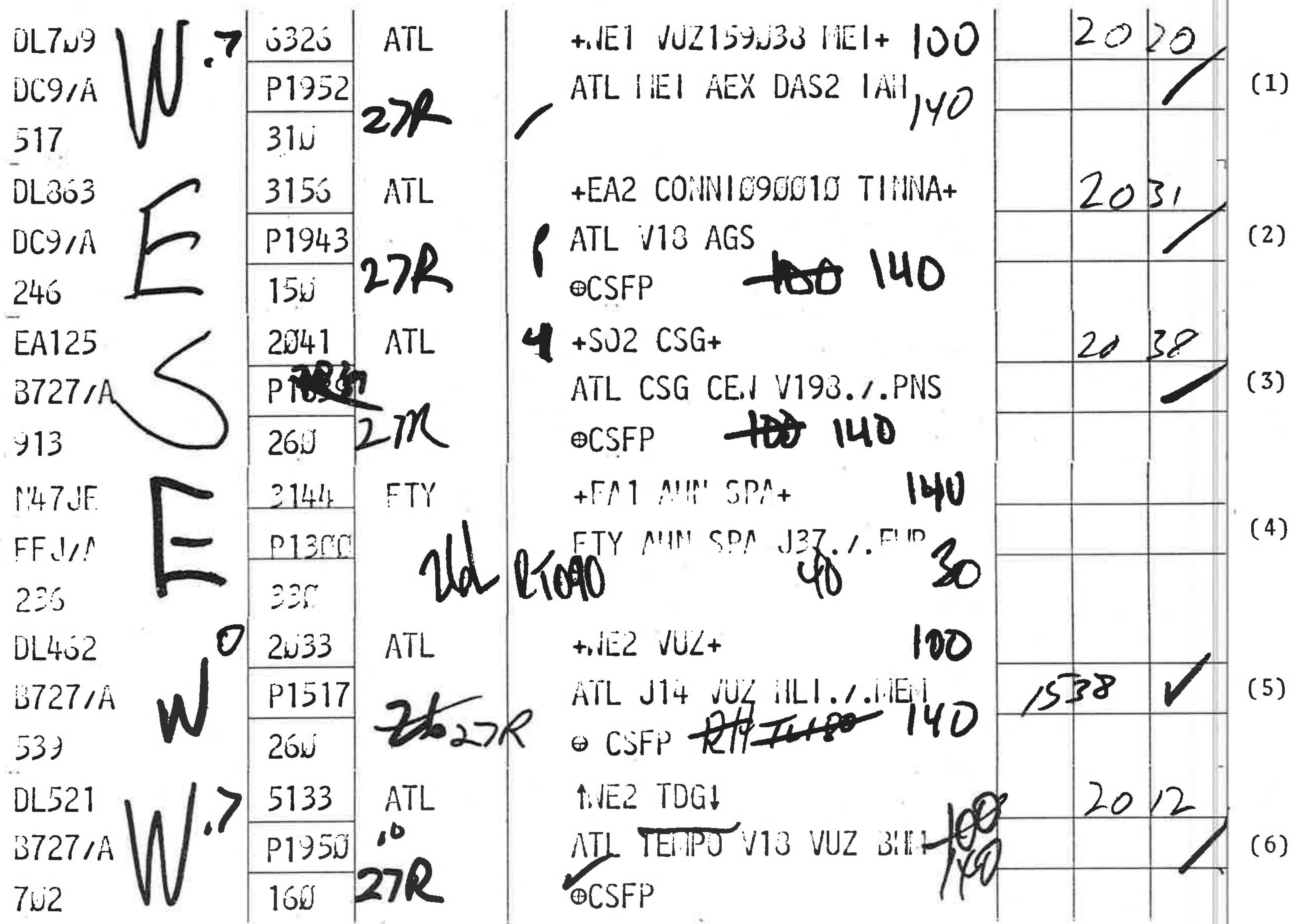


FIGURE A-2. DEPARTURE FLIGHT STRIP EXAMPLES

DL315	S	5102	ATL	↑3024↓	T	30			
DC9/A		P1703	27R	ATL ~~V97 GRANT~~ CSG				✓	(7)
304		100		⊕CSSFP 100					
EA626	E	2006	ATL	+EA2 AHN GSO+	~~100~~	1509			
DC9/A		P1445	26	ATL SPA J14 RIC	140			/	(8)
708		290	~~27R~~	WEIGHT					
EA673	S	2005	ATL	+S02 MCN265039 J43 NEDDY+			15	19	
DC9/A		P1333		ATL ~~J43~~ TLH	100			✓	(9)
392		210	27R	⊕CSFP	140				
DL1708	ATYD N	6360	ATL	+N01 CHA BNA+					
DC9/A		P1518	26	ATL J45 BNA AML/.MCI		1532		✓	(10)
035		310		140 [illegible]					
N4366F	S	2007	ATL	+S01 MCN+		40			
FFJ/A		P1645	H-1 27R	ATL MCN J45 JAX				✓	(11)
932		290		~~100~~ 140					
N122RP	7 N	3123	ATL (1)	+N02 TYS+	100	1813			
N255/A		P1630	26	ATL TYS J91 HNN./.CLE	140			✓	(12)
380		290		⊕CON14 DEPT					

FIGURE A-2. DEPARTURE FLIGHT STRIP EXAMPLES (CONT'D)

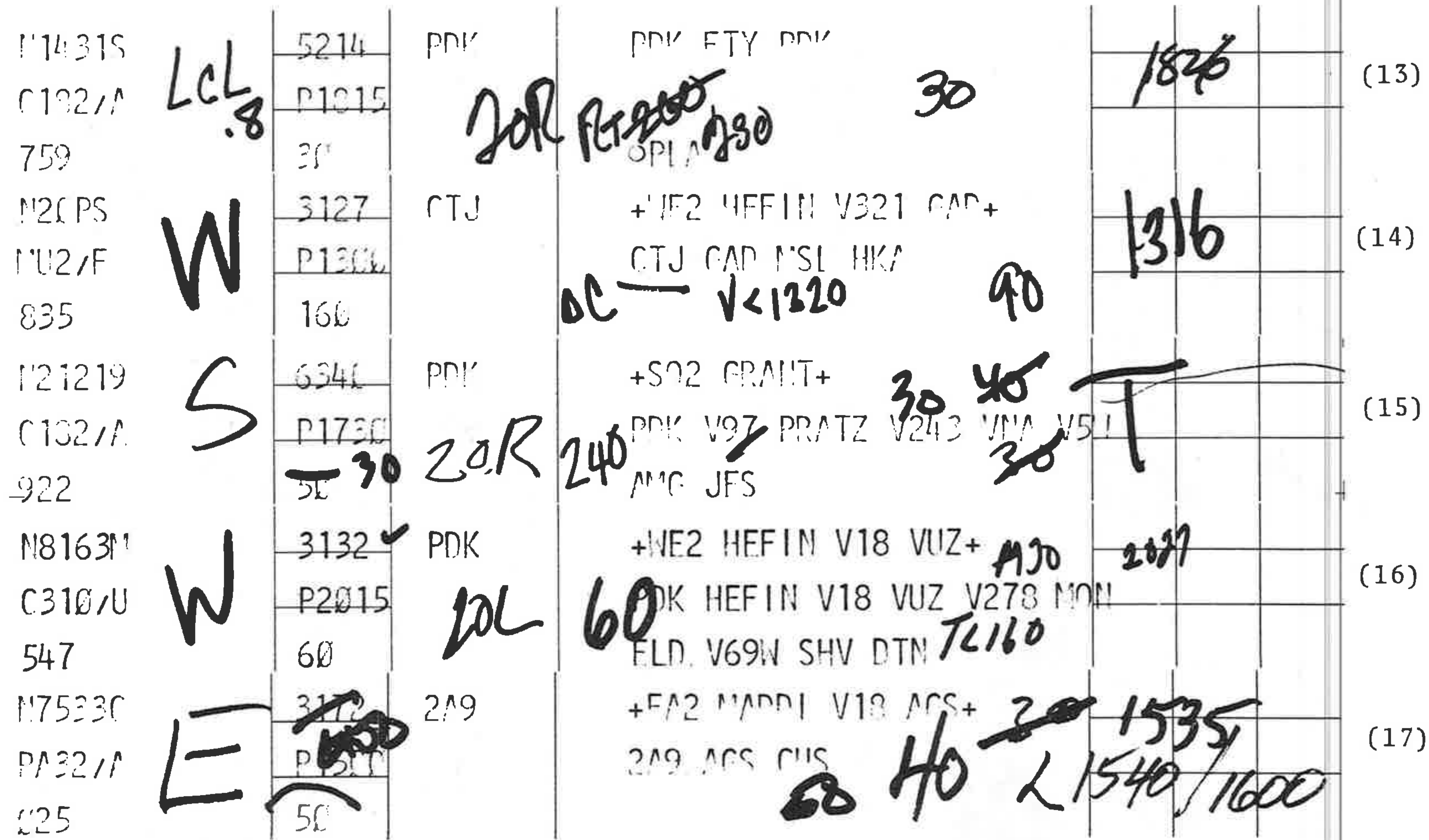


FIGURE A-2. DEPARTURE FLIGHT STRIP EXAMPLES (CONT'D)

TABLE A-2. SAMPLE OF MANUAL NOTATIONS MADE ON DEPARTURE FLIGHT STRIPS

FLIGHT STRIP LOCATION (FIG. 4-9)	MANUAL NOTATIONS	EXAMPLE FLIGHT STRIP (FIG. A-2)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACE 4A	W	1	Departure Vector Area - West	To Emphasize The Type/Direction Of Departures For Quick Controller Reference - Based On Departure Gate Printed Out In Space 9 Between + Signs	CD For Atlanta Departures SATH For Satellite Airport Departures	Routinely
	E	2	" " " - East			
	S	3	" " " - South			
	N	5	" " " - North			
	LCL	13	Local Flight Not Exiting Terminal Area			
	0	5	DR-1 Frequency To Be Contacted 125.0	To Aid DH & SATH In Passing Flight Strips To The Appropriate DR/SAT Positions When The Flight Strips Exit The Drop Tube From The Cab	CD For Atlanta Departures	Controller Dependent But Common
	.7	1	DR-2 Frequency To Be Contacted 125.7			
	0	No Example	SAT-2 Frequency To Be Contacted 121.0			
	.3	No Example	SAT-1 Frequency To Be Contacted 119.3			
	.8	13	SAT-3 Frequency To Be Contacted 119.8			
SPACE 5	6360	10	?	?	?	Controller Dependent And Rare
	3132✓	16	Beacon Code Verified	Service Provided Pilot And Recorded	DR For Atlanta Departures SAT For Satellite Departures	Controller Dependent And Not Commonly Recorded
	~~3172~~ 6150	17	Beacon Code Changed Via A Notification Strip	To Note Change To The Filed Flight Plan	CD For Atlanta Departures SATH For Satellite Departures	Routinely
SPACE 6	P~~1839~~ 2039	3	Two Hour Departure Delay - Received Either By Pilot Call In Or Notification Strip	To Note Change To The Filed Flight Plan	CD for Atlanta Departures SATH For Satellite Departures	Routinely
SPACE 7	100	7	Requested Altitude (10,000 FT)	To Emphasize An Uncommon Altitude Request (Below 14,000)	CD	Routinely
	~~50~~ 30	15	Requested Altitude Changed Via Pilot Call In	To Note Change To The Filed Flight Plan	CD for Atlanta Departures SATH For Satellite Departures	Routinely

TABLE A-2. SAMPLE OF MANUAL NOTATIONS MADE ON DEPARTURE FLIGHT STRIPS (CONT'D)

FLIGHT STRIP LOCATION (FIGURE 4-9)	NOTATION	EXAMPLE FLIGHT STRIP (FIG. A-2)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACE 8A	H-1 1 LKH	11 12 No Example	Departure Pickup Point Hanger 1 Departure Pickup Point Lockheed Ramp Area	To Aid GC By Noting Uncommon Departure Initial Contact Points	CD	Routinely
SPACE 8B	27R	1	Runway Assignment At ATL	To Aid GC And LC In Handling Their Traffic	CD	Routinely
	26L	4	Runway Assignment At Satellite Airport	To Aid SAT In Handling His Traffic	SATH	Routinely
SPACE 9	✓	1	?	?	?	Controller Dependent And Rare
	P	2	?	?	?	Controller Dependent And Rare
	~~100~~ 140	2	Altitude Instruction In Hundreds Of Feet	Reminder That Instruction Issued	DR For Altanta Departures SAT For Satellite Departures	Routinely
	RT090	4	Heading Instruction To Be Issued By Control Tower Prior To Handoff Right Turn 90 Deg.	To Aid LC And DR In Handling The Flight	SATH For Satellite Departures	Routinely
	~~TEMPO~~ ~~V97~~ ~~GRANT~~	6 7	Changes In Filed Flight Plans	To Note Filed Flight Plan Changes	CD For Atlanta Departures SATH For Satellite Departures	Routinely
	WEIGHT	8	Aircraft Too Heavy For Active Departure Runway	To Aid LC And DR In Handling The Flight	CD	Routinely
	V < 1320	14	Takeoff Clearance Void If Not Off By 1320	Reminder Of Void Time Instr. Issued Departure From A Non-Towered Airport	SATH Or SAT	Routinely
	OC	14	Cleared On Course - No Vectors Issued Due To Lack Of Traffic Expected Along Flight's Path Through Terminal Area	Reminder That Clearance Instruction Issued	SATH Or SAT	Routinely

TABLE A-2. SAMPLE OF MANUAL NOTATIONS MADE ON DEPARTURE FLIGHT STRIPS (CONT'D)

FLIGHT STRIP LOCATION (FIGURE 4-9)	NOTATION	EXAMPLE FLIGHT STRIP (FIG. A-2)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACE 9B	T	7	Tower En Route Controlled Flight	To Emphasize The Type Of Flight Primarily For Traffic Counting Purposes	CD For Atlanta Departures SATH For Satellite Departures	Routinely Marked But Not Needed By Controllers To Control Traffic
SPACE 10	1540	No Example	Expected Engine Start Time			Not Used
SPACES 11&12	2020	1 13	Time Of LiftOff Time SAT Makes Radar Contact	Of No Real Use Today - A Holdover From Non-Radar Departure Control Days	LC For Atlanta Departures SAT For Satellite Departures	Routine
SPACE 13	1600	No Example	Revised Engine Start Time			Not Used
SPACE 15	✓	1	Clearance Read	Reminder Of Completed Action	CD For Atlanta Departures SATH For Satellite Departures	Routinely Marked o Used by SATH o Not Used By CD Who Handsoff Strip Immediately After Reading Clearance
SPACE 16	1615	No Example	Time Pilot Calls Ready To Start Engines			Not Used
SPACE 17	1620	No Example	Time Pilot Advised To Start Engines			Not Used
SPACE 18	1630	No Example	Time Pilot Calls Ready To Taxi			Not Used

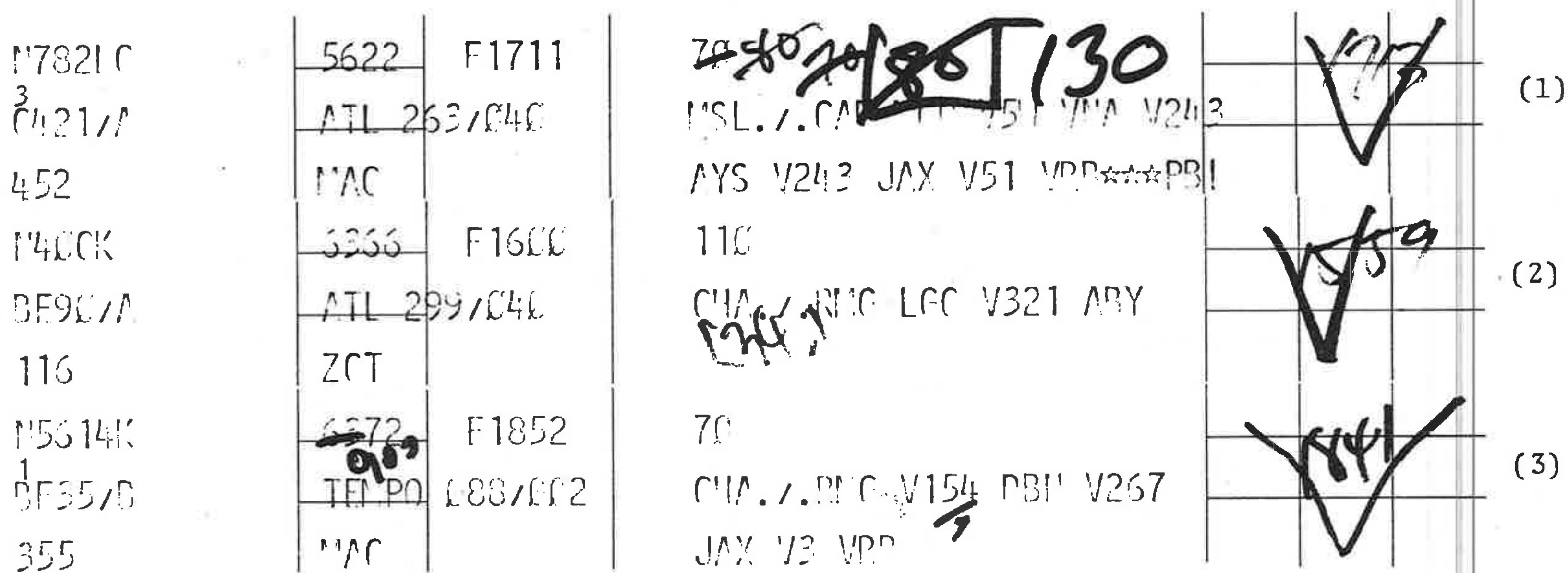


FIGURE A-3. OVERFLIGHT FLIGHT STRIP EXAMPLES

TABLE A-3. SAMPLE OF MANUAL NOTATIONS MADE ON OVERFLIGHT FLIGHT STRIPS

FLIGHT STRIP LOCATION (FIGURE 4-10)	NOTATION	EXAMPLE FLIGHT STRIP (FIG. A-3)	MEANING	PURPOSE	WRITTEN BY	EXTENT NOTATION USED
SPACE 5	~~6372~~ 900	3	Beacon Code Changed	To Note Change To The Filed Flight Plan	DH For DR Airspace Overflights SATH For SAT Airspace Overflights	Routinely
SPACE 9	~~70~~ ~~80~~ 130	1	Altitude Instructions In Hundreds Of Feet	Reminder That Instruction Issued	DR And SAT	Routinely
	134.1	2	An En Route Control Frequency	Reminder That An Uncommon Handoff Freq. Issued	DR And SAT	Routinely
	V154 / 7	3	Flight Joined Airway On V154	?	DH/DR And SATH/SAT	?
SPACE 9A	T	No Example	Tower En Route Controlled Flight	To Emphasize The Type Of Flight Primarily For Traffic Counting Purposes	DH/DR And SATH/SAT	Routinely Marked But Not Needed By Controllers To Control Traffic
SPACE 13	1713	1	Time of ARTS Handoff To The TRACON (40 Miles From ATL VOR)	Of No Real Use Today - A Holdover From Non-Radar Control Days	DH/DR And SATH/SAT	Routinely
SPACES 10-18	V	1	Overflight Symbol	To Emphasize That Flight Is Neither An Arrival Nor Departure And Requires Special Handling	DH For DR Airspace Overflight SATH For SAT Airspace Overflights	Routinely

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